GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

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EDITORIAL NOTES.

Gas Oil Prices.

THE gas industry has a genuine grievance in respect of the continued high price of gas oil. There is no excuse for it; and the industry deserves better treatment—and voluntarily—on the part of the oil companies, instead of being forced to take steps to compel reductions. Both Mr. Frank Livesey, of Maidstone, and Mr. J. F. Tyndall, of Deal, have in our columns urged gas undertakings to stiffen their backs against the oil magnates. The former suggested that buyers of gas oil should hold off, and refuse to contract ahead, except at pre-strike prices, in order to bring the sellers into line with the producers of solid fuel, who are now quoting pre-strike figures. Mr. Tyndall proposes, with the same object in view, that fatter coal gas should be made and blue water gas be used with it, instead of employing oil enrichment. He is practising what he preaches. There is no reason whatever why oil prices should be what they are; to maintain them is ill recompense for the golden patronage the industry has been giving the oil interests during the past year. Furthermore, it is entirely a short-sighted policy, inasmuch as it offers no encouragement to increase the normal application of oil for enrichment. Carburetted water gas is, on the thermal basis, more costly than coal gas at to-day's prices for materials; and that is a condition to spur gas suppliers to do all possible to limit the production of the one, and increase that of the other. This is a point which should be pondered by the oil people. It is in their hands to contribute to an alteration.

Regarding the absence of justification for the existing high prices of oil, Mr. Tyndall called attention to an article in the "Manchester Guardian Commercial Supplement" for March 24. The article deals with the oil slump in America—a slump brought about by over-production, which at present shows no sign of abatement. The writer informs his readers that, during the week ended March 13, crude oil was being produced in America at the rate of 900,000,000 barrels a year. The output last year was 764,000,000 barrels, while a year ago the daily average output was only at the rate of 708,000,000 barrels a year. In other words, the present production of crude oil is about 27 p.ct. greater than it was a year ago. The source of the rise in production is centred chiefly in the light oil fields. Of the present production of 2,461,000 barrels per day, no less than 1,937,273 barrels represent light crude oil. The writer of the article can see no quick relief from the burden of over-production. So much for the reason for the slump in America—a condition reflected in this country in the price of petrol, but not in that of gas oil.

The imports of gas oil do not alone give a fair measure of the big demand there was last year—to the enrichment of the oil companies—for gas oil by the gas undertakings in this country. As has already been shown in the "JOURNAL," the imports of gas oil last year amounted to 117·04 million gallons, as against 72·65 millions in the preceding year—an increase of 44·39 millions. The re-exports of gas oil last year amounted to 1·46 millions, so that there is a net amount of 115·58 million gallons of imported gas oil available for use here. But these figures are not completely representative. During the past few years, there has been a remarkable growth of the oil-refining industry in this country. This is indicated by the increase of imported crude petroleum from Persia, Venezuela, Mexico, Colombia, and the United States. In 1913, the imports of crude petroleum were about 1 million gallons; in 1925, 569 millions; and in 1926, 539 millions. The home production of gas oil from imported and native petroleum and from shale last year was 28·79 million gallons, of which 2·51 millions were exported—leaving a balance of 26·28 million gallons. Adding this to the 115·58 millions of retained imported gas oil, we had last year available for use in this country 141·86 million gallons, which compares with 97·56 millions in 1925, or an increase of 44·30 million gallons. These figures are a good indication of the patronage received by the oil interests last year from the gas undertakings of this country, and at a high price in a time of stress and trouble. From that high price the oil companies evince a disinclination to recede to an extent justified by the facts. There are excellent grounds for suggesting to them that they should reconsider their policy.

The "Petroleum Times" market report for April 16 announced that the prices of gas oil had been reduced from April 11 for all methods of delivery: In rail tank cars—*i.e.*, 10-ton lots—to 5½d., and in smaller quantities of 1000 gallons and upwards to 5¾d. per gallon, net and naked, *ex* wharf. On the same basis, the market quotation on Oct. 10, 1925, was 4¾d.; on Jan. 9, 1926, it advanced to 5⅛d.; on June 3 to 5⅜d.; and on Nov. 2 to 6⅛d. The present reduction to 5½d. and 5¾d. will not give satisfaction.

Centralized Gas-Production Project for Germany.

LIGHT upon the revolutionary scheme for supplying practically the whole of Germany with coke-oven gas from the Ruhr coalfields comes on the instalment principle. It was pointed out in the "JOURNAL" for March 30 that behind this ambitious project are the powerful coal, iron, and steel interests of Germany. Now (as will be seen from a translation in later columns) the question has developed into a sort of triangular struggle, in which the parties are the coal and iron interests, the brown coal interests, and the gas industry. Although it was known, when last dealing with the scheme, that the attention of the German Government had been called to it, we were unaware that there had already been formal discussion with the Standing Technical Committee of the Government Coal Council. This is the case; and it is a sketch of what then transpired that is published in this issue. The question is wholly an economic one—not merely in its genesis and as things are now, but for all time, because if anything definite is done now in this direction, it cannot very well be altered in the future; at any rate, it would be extremely difficult.

To the Committee referred to, the promoters of the Ruhr scheme apparently expounded, in very general terms, their views on the subject; and they also indicated some of the lines on which, in their opinion, development should proceed. It will be seen that initially they are proposing a number of long-distance mains for the high-pressure transmission of gas which would radiate in different directions from the Ruhr fields; and these mains they suggest—probably with the view of composing some of the opposition—could act as receivers for gas supplies from other coalfields. The radial mains could be interconnected, so that no city or town would be dependent on one line alone. In this way, a grid would be formed, after the

fashion contemplated in connection with the generation and distribution of electricity in this country. As indicated above, an entrance into the arena has been made by the brown coal interests, who naturally also support the principle of the centralized provision of gas by collieries, but only on the understanding that they are allowed to participate. The brown coal representatives aver that they are prepared to supply large quantities of gas of the same quality as that obtained from bituminous coal; but their contention that the location of the brown coal deposits will render unnecessary long costly mains from the Ruhr will not be altogether to the liking of the originators of the centralization of supply at the coke-oven plants. Therefore, the brown coal owners submit that there shall be a division between them and the Ruhr owners of the gas supply to the country. In other words, the gas industry is, metaphorically speaking, the bone, and the Ruhr coal and iron interests on the one hand and the brown coal interests on the other are the dogs struggling for its partition between them. The position is becoming extraordinarily interesting, though the scheme has been only adumbrated, without solid facts and figures which can be closely investigated with the view of ascertaining the relative economic virtues of centralized gas supply as proposed by these interests, and of a greater centralization at super gas-works, which would be the possessions of the gas industry.

The Ruhr magnates are conscious of the fact that from the gas industry there will be very strong resistance to their scheme. The German gas industry is altogether unprepared to be reduced to the position of mere purveyors of gas; and its prominent administrators are anything but convinced that for them permanent economy lies in the direction of supplies of gas from coke-ovens through high-pressure transmission mains, which would transfer the very foundations of gas supply to the coal and iron industries. One would imagine from the reports that the Ruhr coal magnates had in this matter risen to great heights in altruism, and had nothing before them but the best economic interests of the country. They wave aside as wholly preposterous any idea that they have in view the shutting-down of every gas-works which is at present producing economically, and substituting high-pressure supply from the coke-ovens. They magnanimously say that the two systems must live together, and that choice must be made upon the economic and social circumstances of each individual centre, just as is the case already with regard to electricity supplies. That is the voice of the enticer. Notwithstanding, we can hardly imagine that the coke-oven interests would not, when firmly established in the business of gas providers, bring pressure to bear to prevent further expenditure of capital on manufacturing plant by gas undertakings, so that, their plant gradually becoming obsolescent, naturally they could not compete with the coke-oven supplies, as probably they could do by being able to utilize the developments in plant. It is perfectly clear that there would be little opportunity for gas undertakings which had committed themselves to coke-oven supply to take advantage of whatever advances were made in gas plant, in order to produce more economically, in view of the fact that the Ruhr coke-oven owners propose that contracts should have a duration of at least thirty years. Moreover, with the heavy capital expenditure which would be involved in the provision of the transmission and interconnecting mains, together with the pumping, compression, and auxiliary plant for high-pressure transmission, they would have to invoke the authorities to do all possible to secure the largest possible consumption for their system. It is obvious that, in these circumstances, the gas industry would be completely shackled to these sources of gas supply, not only for thirty years, but always.

The colliery owners, however, have confidence that, including the capital charges for manufacturing plant, gas-works (other than in distant places with a low consumption) could not compete with coke-oven gas in regard to price. There would be, they submit, no necessity for gas undertakings to indulge in fresh capital expenditure for producing plant, which would be the chief attraction to them—not such an attraction as is supposed, postulated, or pretended. They propose that they should sell merely in bulk to gas suppliers, and not have anything to do with the charge to the ordinary consumer, to whom they hold out the bright prospect of rapid reductions in price, and therefore the ability economically to use gas for any and every purpose to which they desire to apply it. As a further evidence of their disinterestedness in this matter, they suggest that the Coal Council, who already regulate coal and coke prices, could regulate the price of gas *ex*-coke-ovens, and that the price should be based not upon a fixed monetary rate, but on the equivalent of the fixed weight of marketable coal. In other words, gas cost in bulk would vary with the open market value of the coal. The gas industry believes that gas production is bound to be largely centralized in future, with distribution to the outlying districts by high-pressure transmission. But the industry is not convinced that it would be better for the centralization of production to be at the coke-ovens rather than at super gas-works, under its own immediate control, to which coal would be conveyed.

The German gas industry, it is clear from the translation, is fully prepared for a most critical inquiry. There is conviction on their side that much of what is proposed, and the anticipations to which expression has been given, are highly exaggerated, as would be proved by critical examination of all the factors in the case. We have no doubt gas undertakings would be prepared to purchase gas, where economically possible; but this scheme embodies in it the seeds of ultimate compulsion, and of concentration of the fuel supplies of Germany in one set of hands. In our opinion, there is more underlying this project than meets the eye.

That some of the important gas undertakings are viewing these developments with anything but a friendly eye, and are not highly enamoured of their position under the control of the Coal-Selling Syndicate of Germany, is evidenced by a report which has appeared in the "Vossische Zeitung," of which we also give a translation in this issue. This German contemporary states, on "reliable authority," that the cities of Frankfurt and Cologne (possibly there will be participation by Düsseldorf) are jointly engaged in negotiations, which promise success, for the acquisition of an unworked coal area in the Ruhr district; the object being to develop the field, and ensure for their gas-works coal supplies from their own pits. The capital expenditure which would be involved would be equal to some 5 millions sterling. In addition to obtaining supplies from their own pits, they desire to make themselves independent of the present monopoly of the Rhine Westphalian Coal Syndicate, and their price policy. It is believed that the field involved in the scheme will yield something like 325 million tons of coal. The gas projects of Germany are at the present time of a peculiarly fascinating and gigantic order.

Assessment of Underground Distributing Systems.

It will be remembered that some time ago the Electricity Commissioners appointed an Advisory Committee to report to them as to the steps which were being, or could be, taken by authorized electricity undertakings to increase the consumption of electrical energy for domestic purposes, and what, if any, new legislative powers would be necessary to give effect to any of their recommendations. Comment was made upon the report at the time of its issue. It was dated July 17 last year; but it appears that it has not yet been fully considered by the Commissioners. One of the recommendations of the Advisory Committee referred to assessments for local rating; the opinion being expressed that the assessing of electricity supply undertakings requires immediate amendment. The idea of the Committee is that "electricity undertakings should be assessed on the basis of the profits of the undertakings, with a rebate of such a sum as would represent 75 p.ct. of the sum payable on account of the general district rate in respect of underground cables and works." The General Purposes Committee of the London County Council consider that representations should be made forthwith on this particular recommendation; for it is obvious they can see no reason for any preferential treatment of electricity cables.

It is thought probable by the Local Government Committee of the Council that the recommendation is based on

the precedent of section 211 (1) (*b*) of the Public Health Act, 1875, which defines seven classes of property which shall be assessed to the general district rate at one-fourth only of their net annual value. None of these properties is analogous to electric cables; the nearest approach among them being railway lines. However, by the Rating and Valuation Act, 1925, the general district rate is abolished as a separate rate; but the effect of the exemption is continued by reducing the value on which rates will be levied by a stereotyped amount, representing the average amount of the relief from the general district rate over the period of ten years 1914 to 1924. As the Local Government Committee of the Council say, the expenditure met out of the general district rate was largely in respect of roads, and, in granting the exemption by the Public Health Act, it was no doubt considered that land, railway lines, and the other classes of property mentioned did not greatly benefit by this expenditure. As already suggested, there is little, if any, analogy between underground electricity cables and the other classes of property in question, seeing that cables are generally laid under the public streets and roads. We should not blame the electricity industry for trying to secure the 75 p.ct. rebate; but there would be strong objection if any differentiation were made in favour of electricity cables against gas and water mains. Gas undertakings would gladly welcome a rebate such as is suggested for electricity cables; but there must be no preference to electricity. Discussing this, the Local Government Committee of the Council say:

> The assessments of water and gas undertakings are based on profits in the same way as electricity undertakings; no exemption being allowed in respect of their mains. If electricity mains were partially exempted from assessment, the other ratepayers (including gas companies) would have to bear the loss of rates resulting from the exemption. There is frequently active competition between gas and electricity undertakings; and it would be manifestly unfair to impose on gas undertakings additional rates in order to relieve their competitors. If partial exemption were granted to electricity cables, it would be difficult to refuse it to gas mains and other similar classes of property.

It would be a different matter if there were general exemption for those who have property under (or permanently on the surface of) roads, and are engaged in services of public utility. As a matter of fact, an attempt was made, during the Committee stage of the Rating and Valuation Bill, to secure an amendment granting exemption (similar to that enjoyed by railways) in respect of the underground mains and pipes of gas, water, and electricity undertakings, and of the rails, tracks, &c., of tramways. There was a withdrawal of this as well as other amendments contemplating exemptions, on the representation of the Ministry of Health that this was not the proper occasion to alter the law. Going further back, the Royal Committee on Local Taxation in 1901 strongly reported against the extension of exemptions. However, while it is true the recommendation of the Advisory Committee on Domestic Electricity Supplies relates only to general district rate purposes, and does not affect London, there is some apprehension on the part of the General Purposes Committee of the Council that, if the rebate were conceded outside London, it might be difficult to resist an application for a similar rebate in London. Hence the recommendation is considered to be undesirable; and the Electricity Commissioners are to be so informed. There would be no objection on the part of the gas industry if their underground distribution works were assessed on precisely the same basis; but there must be no preferential treatment. If there were, there would be trouble.

The Budget.

Both inside and outside the House of Commons, a good reception has been given to the third Budget of the Chancellor of the Exchequer, the Rt. Hon. Winston Churchill. There is not much in it to give ground for hope of a reduction of taxation—at any rate, for some little time to come. But, on the other hand, for the essential industries, there is nothing in it which will increase their already heavy obligations to the National Exchequer. Of course, the Government are not responsible for the fact that the national balance-sheet for last fiscal year would not balance. But had it not been for the criminal folly to which the country was subjected at the hands of Trade Unions, there is little question that Mr. Churchill would have been able to present to the House a balance-sheet which would have shown that the estimates he gave this time last year, on the basis of a peaceful year, would have been fully justified. The statistics he submitted proved the enormous damage done to the trade and the country's finances through the general strike and the coal stoppage. Summing up their effects upon the last and this Budget, it may be said that in 1926 there was a decrease of revenue of over £17,500,000, and an increase of expenditure of upwards of £14,500,000—making a total loss to the Exchequer of £32,000,000. This, as the Chancellor said, is the overwhelming cost which is involved in the deficit of £36,000,000 in the finance of 1926, and which confronts us with a severe additional loss in 1927. When we reflect upon all that happened last year, the marvel is, as the Chancellor put it, not that we have suffered so much, but that we have not suffered more from the shocking breakdown in our island civilization. The fact that we have not done so is a fine tribute to the resiliency and resources of Great Britain.

Regarding the current year, Mr. Churchill proposes to raise the enormous revenue of £834,000,000 without adding to income-tax, and increasing indirect taxation by only a little more than £5,500,000. On all hands, there has been admiration of the ingenuity shown by the Chancellor in effecting a balance of his estimates for the current year; but the ingenuity has its limits, in that it involves the bringing into this year of revenue at the expense of subsequent years. Moreover, Mr. Churchill has had the temerity, in addition to covering the estimated deficit for this year, to add £15,000,000 to the statutory £50,000,000 for sinking fund; but this is to be managed in a way which does not meet with universal approbation, although accepted, as no better route can be found from the difficult position. Towards the increased revenue of £37,680,000 for which the Chancellor has budgeted, the increase in indirect taxation, as already pointed out, will only provide a little more than £5,500,000; and the balance is being secured by appropriating £12,000,000 from the Road Fund Reserve, taking £5,000,000 from shortened brewers' credit, and procuring £14,800,000 by the collection of landlords' property tax in one instalment. This means that the current year's revenue will be increased to the extent of £32,000,000 by anticipating that of subsequent years. In the circumstances, no one perhaps will feel inclined severely to criticize the transfer of the £12,000,000 from the Road Fund Reserve, although the same argument would apply now as heretofore regarding the utilization of a fund raised for a specific purpose to meet other expenditure which should rightly be covered by general taxation. It simply means that those who have contributed, by way of special taxation, to this fund for improving the highways and by-ways of the country are paying a super-tax compared with those taxpayers who are not owners of motor-cars.

Among the changes announced by the Chancellor in which there will be more or less interest in the gas industry is the proposal to abolish the Ministry of Transport, the Department of Mines, and the Overseas Trade Department; but it is unlikely that these changes will effect any great economy beyond the saving of ministerial salaries, seeing that all the proposal means is that there is to be a termination of the separate existence of the Departments, their work and staffs being transferred to other Departments. The Chancellor declared that the Government have a programme of economies upon which they are working; but he did not enlarge on this, and therefore it inspires little hope of a reduction of departmental spending. Individually, we shall be glad of the simplification of income-tax returns, which is a reform long overdue. For the rest, all we as an industry can be thankful for is that the Budget, practically speaking, leaves us where we were, and that perhaps is a better position than was generally anticipated, in view of the tragic conditions of last year. Mr. Churchill regards the prospects of trading for this year as promising; but he does not think that we must place our hopes too high in respect of its financial outcome.

New President and Vice-President.

We learn from the minutes of the Council of the Institution of Gas Engineers that their nominations for the high offices of the Institution for 1927-28 are: Mr. H. D. Madden, M.Inst.C.E., of Cardiff, for the Presidency, and Mr. John Terrace, M.Inst.C.E., Engineer of the South Suburban Gas Company, as Vice-President. With Mr. Madden's ascent to the Presidential Chair, the Senior Vice-President will be Mr. John W. McLusky, of Glasgow.

Testing for Calorific Power.

On a later page, an article appears from Dr. W. B. Davidson on dry gas and testing for calorific value—a subject to which Mr. Thomas Hardie directed attention in his Presidential Address to the Southern Association. In the minutes of the Council of the Institution of Gas Engineers, published this week, there is the following reference: "The report of the Committee appointed by the Council, at the request of the National Gas Council, to consider the standards of temperature, pressure, and humidity of gas in the determination of calorific value, as imposed by the Gas Regulation Act of 1920, was accepted and adopted, as was also the report of the Committee on Gas-Fires for Clinical Purposes."

Coal Exports and Imports.

Pending fuller notice, it may be mentioned that coal exports during March rose in value by £477,107 to £4,459,789. The quantity of coal exported was 4,819,942 tons, compared with 4,702,536 tons in March last year. It is remarkable how quickly the export trade has recovered the ground lost through the coal stoppage; but the business which went to other countries, during the stoppage period, cannot be recouped. The value of the imports of coal in March amounted to £252,268; but we must now be approaching the end of deliveries under the safeguarding contracts entered into for foreign coal.

Trade Union Bill.

The second reading of the Trades Disputes and Trade Unions Bill is fixed for Monday, May 2. During the past week, there has been little further revelation as to the feelings of the labour leaders on the subject. After the first outburst, quietness has again reigned; but probably this is only the calm before the storm. The Government, however, have no intention of attempting in any way to silence the opponents of the measure. The former know the strength of their case; the country are well acquainted with the damage done last May by those in command of the trade union movement. Behind the Government practically the whole country stands, excepting those in the labour world who hold extreme views, or who as leaders prefer to divest every member of the labour organizations of the power to exercise individual will. The idea that trade unionists are unanimously hostile to the Government measure (which is intended to give them emancipation) has no foundation in fact. Members of Parliament are receiving many communications from constituents who are members of trade unions urging definite support of the Government Bill. This is highly encouraging. They may rest assured that the Government will not be deterred by the rabid declamations and protests of the trade union leaders from proceeding with a measure which is for the protection not only of the country, but of individual liberty, whether of trade unionists or otherwise.

Employment.

The list of unemployed in the country is gradually dwindling to figures which are more representative of those obtaining in the early part of last year than they have been since the deplorable events of the first week in May. On April 4, the number of persons registered as unemployed at the employment exchanges was 1,073,800. This was 7929 less than the week before, but 24,014 more than in the corresponding week a year ago.

Co-partnership and Trade Unions.

Some trade union leaders are favourable to the workers enjoying a partnership in the results of industry; others, possibly with an eye on their own comfortable occupation, ignore their duty to operate for the greatest good for the greatest number. The guest at the Co-partnership Association luncheon on the 7th inst.—with Mr. F. M'Leod, of the South Metropolitan Gas Company, presiding—was Lieut.-Commander the Rt. Hon. E. Hilton Young, M.P. He spoke of the under-current of hostility to co-partnership in the trade union world, and expressed the belief that the system would actually enrich and advance trade unionism, would have an immensely beneficial effect on the wage earner, and would free industry from the atmosphere of mutual hostility. There is no question—experience proves it—that co-partnership does develop community of interest, and does assist to obliterate class hostility. It must, however, be realized that converting wage earners into profit receivers may possibly weaken the trade organizations, and indeed replace them. The difficulty is that the trade union organizer must be satisfied that this is a good, and not a bad, thing for the workers. Nothing is to be lost by superposing on industrial conditions closer relations between the works and the men; there is, in fact, more to be gained than lost. The growth of a new unity would, in the opinion of Lieut.-Commander Hilton Young, have an immensely beneficial effect in stabilizing employment, and securing more reliable service in return.

Worries of the Miners' Federation.

The débris of last year's quixotic and deplorably disastrous adventure of the Miners' Federation is not pleasant for the Executive. Apart from the financial aspect, they have to contemplate the fact that, on March 21 last, the number of insured persons, classified as belonging to the coal-mining industry, recorded as unemployed was 205,751, of whom 121,385 were wholly unemployed, and 84,366 temporarily stopped. Another matter which is worrying them is the uncertainty that exists as to the future of the Federation, which is an organization now largely discredited in the coalfields, and entirely so by the nation. Many miners in each area are viewing the policy and management in a new light; and the Executive are considering how best to get the Federation re-established as the central organization. They will not do it under the ægis of the Minority Movement, which would only intensify the objection of a big mass of the miners to be the tools again of the extremists. Another thing the Executive had to consider at their meeting last Wednesday was the position of Mr. Frank Hodges, the Secretary of the Miners' International Federation, in relation to Mr. Cook, their own Secretary. It is Mr. Cook who really wishes to secure the discharge of Mr. Hodges from the international organization—on the proclaimed ground that he has been elected a member of the Central Electricity Board in this country, but actually to punish him for his truthful and candid criticism of the leaders of the Miners' Federation, particularly Mr. Cook, during the stoppage last year. The Executive are in a quandary. They seem to fear Mr. Cook's tongue; and so it is possible they will advise (though the advice may not be accepted) that the level-headed Mr. Hodges ought to go from office in the International, while the firebrand and loquacious Cook continues as the Secretary of the British organization. The courage of the Executive is of a microscopic order. We are afraid the delegates from the British Federation will not cut very presentable figures at the next meeting of the international organization. They are extraordinarily limp and short-sighted.

"A.G.A." New Address.—The American Gas Association announce that, on and after April 18, the Headquarters Office will be located in the new Graybar Building, 420, Lexington Avenue, New York City, 43rd and 44th Streets.

A Course on Technical Gas Analysis.—The Sir John Cass Technical Institute, of Jewry Street, E.C., announce a course on technical gas analysis, by Mr. Ernest W. Yeoman, M.Sc., A.R.C.S., A.R.S.M., F.I.C., which has been specially arranged to meet the requirements of technological students in the chemical and metallurgical industries. The course will be held on Wednesday evenings from 7 to 10 p.m., commencing April 27. There will be nine meetings of the class, each of which will be devoted to practical work in the laboratory, preceded by a demonstration. The fee for students resident in the Administrative County of London and in Middlesex and Kent is 10s. An extra charge is made to students who live outside this area. Students under 18 years of age are admitted at half fees.

PERSONAL.

Dr. M. W. TRAVERS has been appointed Reader in Applied Physical Chemistry and an Honorary Professor in the University of Bristol.

Mr. G. F. GROVE, Chairman of the Halesowen Gas Company, entertained the staff and workpeople in celebration of his golden wedding; and there was presented to him a set of English cut table glass.

The latest list of members elected to the Society of Chemical Industry includes Mr. REGINALD BAKER, pupil gas engineer; Mr. ARTHUR J. DAISH, Gas-Works, Monkbridge, York; and Mr. FREDERICK NICHOLLS, Redheugh Gas-Works, Gateshead-on-Tyne.

At a meeting of the Institution of Civil Engineers on April 5, the election of ten members was reported. These included Mr. WILLIAM EAMES CATON, General Manager and Engineer of the Oxford Gas Light and Coke Company, and Mr. ANDREW WILSON, General Manager of the Australian Gas Light Company, Sydney, N.S.W.

OBITUARY.

The death is announced at Codsall, Wolverhampton, at the age of 83, of Mr. ALBERT JONES, a former Secretary of the Wolverhampton Gas Company. He joined the service of the Company in 1864, becoming Secretary in 1872, and in 1923, on his retirement, was elected to a seat at the Board. Directors, officials, and staff of the Company were represented at the funeral.

EVENING STAR CHAPTER, No. 1719.

Installation Convocation.

The Installation Convocation of the Evening Star Chapter, No. 1719, was held at Freemasons' Hall, Great Queen Street, London, on Wednesday, April 13. There was a large attendance.

At the opening of the Chapter, the M.E.Z. (Ex Comp. Charles Hulme, P.Prov.G.Std.B.Middx.), Ex Comp. Charles Clare (M.E. elect), and Ex Comp. Rae P. Normand (H. elect) presided.

After the preliminary business had been dealt with, Bro. Philip Henry Sugg, of St. Martin's Lodge, No. 2455, having been ballotted for and approved, was conducted through the ceremony of Exaltation, in which the principals were assisted by Ex Comp. W. McDowall as P.S., and Ex Comp. Alfred C. Beal.

In the absence, owing to indisposition, of the Treasurer (Ex Comp. Wm. A. Surridge, P.G.Std.B.), the report of the Audit Committee and accounts for the year 1926-27 were submitted by Ex Comp. Normand, and were accepted and adopted. The finances of the Chapter were shown to be in a satisfactory condition.

Certificates of their Exaltation in the degree were presented to Comps. A. B. Potterton and T. F. C. Potterton.

The installation of principals and investiture of officers for the year 1927-28 was proceeded with, Ex Comp. A. E. Crooger acting as D.C. The complete list is as follows.

LIST OF OFFICERS, 1927-28.

Z.	Ex Comp. Charles Clare
H.	,, Rae P. Normand
J.	,, W. McDowell
Treasurer	,, W. A. Surridge, P.G.St.B.
Scribe E.	,, Alfred C. Beal
D.C.	,, H. W. Packham
Scribe N.	,, Arthur Valon
P.S.	Comp. W. W. Hammond
1st A.S.	,, E. G. Bartholomew
2nd A.S.	,, G. D. Bidwell
Steward	,, H. Dashwood
,,	,, J. R. Masters
Janitor	Ex Comp. R. H. Goddard

Ex Comp. Hulme, on retiring from the office of Z., was the recipient of a Past-Principal's jewel, which had been voted to him in acknowledgement of the services he had so ably rendered the Chapter.

Before the closing of the Chapter, Ex Comp. Clare made reference in sympathetic terms to the loss which had been sustained through the death of Ex Comp. J. S. Granville Grenfell, G.D.C., honorary member of the Chapter, and of Ex Comp. John W. Broadhead, P.Prov.Dep.G.Reg., W. Yorks., a founder and P.Z.

The companions and their guests afterwards dined together in the Connaught Rooms; Ex Comps. Clare, Normand, and McDowall presiding. The Loyal Toast was heartily pledged. That of "The Grand Officers Present and Past," proposed from the Chair, was responded to by Ex Comp. Lionel F. Dunnett, P.A.G.D.C. To "The Visitors," which was given by Comp. A. E. Broadberry, Ex Comp. Sugg Wright and Ex Comp. Bristol made reply.

NATIONAL GAS COUNCIL.

Central Executive Board.

A Meeting of the Central Executive Board of the National Gas Council was held at 28, Grosvenor Gardens, London, S.W. 1, on Tuesday, April 12. In the absence of Sir David Milne-Watson, the chair was taken by Mr. WILLIAM CASH, F.C.A.

ENGINEERS' BILL.

It was reported that the Council, in co-operation with the Institution of Gas Engineers, had considered the Engineers' Bill, 1927, which sought to provide for the registration, and to regulate the qualifications, of engineers.

A conference of various Engineering Institutions had also been held, and appropriate steps taken to prevent the Bill obtaining a second reading.

GAS LEGISLATION.

Further consideration was given to a draft memorandum which the Council had prepared in regard to this matter for submission to the Board of Trade; and this was finally approved by the Board.

RATING AND VALUATION.

Steps which the Council proposed to take with a view to assisting gas undertakings on assessment matters were considered, and the course of action which had been put forward by the Rating and Valuation Committee of the Council and representatives of the District Executive Boards was approved.

WORLD POWER CONFERENCE—LONDON SECTIONAL MEETING, 1928.

It was reported that a Technical Committee had been set-up to prepare a detailed programme for circulation among the various countries represented on the conference. Mr. T. Hardie was appointed to represent the gas industry on this Committee.

REPRESENTATION ON THE GRAND COUNCIL OF THE FEDERATION OF BRITISH INDUSTRIES.

The following representatives were appointed:

Main Group 14, Public Utility, Sub-Group 3.—*Gas:* Mr. F. J. Bradfield, Mr. F. W. Goodenough, Mr. W. J. Sandeman.

Main Group 9, Chemicals, Fertilizers, and Explosives, Section 1.—*Chemicals:* Mr. C. F. Botley, Mr. T. Hardie.

ANNUAL MEETING OF THE DISTRICT EXECUTIVE BOARDS.

It was decided to extend the period for holding annual meetings of District Executive Boards so as to cover the months of April, May, and June.

ELECTRICITY BILL, 1927—IRISH FREE STATE.

Mr. E. J. Fottrell, Joint Manager of the Council, reported an interview with the Minister of Industry and Commerce of the Irish Free State, which took place in Dublin, with a view to protecting the interests of gas undertakings in Ireland under this Bill.

Gas Coke for Industrial Furnaces.

The "Power Engineer" states that in the "Deutsche Kohlen Zeitung" for Jan. 4, L. Buck writes: Although pulverized fuel offers great advantages, it is often difficult and expensive to adapt existing boilers for its combustion. In any case, a certain amount of auxiliary equipment is needed; and it is not always desirable to commit the plant definitely to the burning of pulverized fuel. The author recommends the more extensive use of gas coke in conjunction with other fuels which will facilitate its ignition. For economy and efficiency, the fuels must be mixed in proportions determined by the characteristics of each; the relative prices being also taken into consideration. The "Sandwich" system of firing may be used on chain grates with or without forced draught, a layer of coke being fed on to the grate and covered by a layer of flaming coal. Alternatively, the two fuels may be fed by a double hopper on to a step-grate. A minimum of capital expenditure is required by either of these methods; and the output of an existing boiler can often be increased by from 50 to 100 p.ct. by converting it to mechanical stoking with mixed coke and coal. In a particular case cited by the author, a boiler with stepped grate gave thermal efficiencies of 70, 77, and 80 p.ct., and evaporation ratios of 6·1, 6·5, and 6·8 respectively, when fired with small coal alone, equal parts of coal and coke, and coke alone. For mixed firing, it is recommended that gas coke from 0 to 1¾ in. be mixed with gassy slack coal.

Exhibition of Chemical Apparatus at Essen.—There is to be, from June 7 to 19, at Essen an exhibition of chemical apparatus, simultaneously with the conference of the Association of German Chemists—a body comprising four-fifths of the chemists in Germany. The display will take place on the exhibition ground in the Norbertstrasse; and we are informed that four-fifths of the available space has already been applied for. All communications should be addressed to the offices of the "Achema," Seelze, Hanover.

INSTITUTION OF GAS ENGINEERS.

Council Meeting.

A Meeting of the Council was held at the Queen's Hotel, Hastings, by the kind invitation of the Chairman and Directors of the Hastings and St. Leonards Gas Company, on Monday, April 11, when there were present: Mr. John Wilkinson (President), in the chair; Messrs. C. Dru Drury, Douglas H. Helps, C. Rhodes Armitage, W. H. Bennett, Leonard J. Langford, Philip G. G. Moon, and Harold C. Smith (Ordinary Members of Council); Frank Prentice (Eastern Counties Association), Charles S. Shapley (Manchester District Institution), Francis C. Briggs (Midland Association), James Bell (North British Association), Robert Robertson (Southern Association), Charles F. Botley (Past President), and W. E. Price (Hon. Secretary).

It was reported that Mr. Herbert Lees, of Hexham, had been elected District Member of Council to represent the North of England Association; and that Mr. Thomas Hardie, of London, had been elected as representative of the Southern Association for the year 1927-28.

The report of the Committee appointed by the Council at the request of the National Gas Council to consider the standards of temperature, pressure, and humidity of gas in the determination of calorific value as now imposed by the Gas Regulation Act, 1920, was accepted and adopted, as also was the report of the Committee on gas fires for clinical purposes.

A letter was received expressing the thanks of the National Gas Council for the work of the Committee in preparing evidence which was placed before the National Fuel and Power Committee on behalf of the gas industry.

NEW MEMBERS.

The following were approved as candidates for election at the forthcoming annual meeting:

For the Class of "Member."—Messrs. William Batt (Newcastle-upon-Tyne), James Earl Holliday (Otley), James MacLeod (Glasgow), Ernest Leonard Oughton (London), Thomas Reynolds (Blackpool), Thomas Roydon (Uddingston), Peter Moncrieff Sim (Buckie), John William Thompson (Barnoldswick), Arthur Wilkinson (Beighton and District), and Donald Young (Nottingham).

For the Class of "Associate Member."—Messrs. Henry Standfield Adams (Bilston), James Hughes Cornish, Junr. (Bridgwater), Edward Morgan Edwards (Holyhead), Herbert Donald Greenwood (London), and William Henry Shaw (Nottingham).

The following were admitted as Students: Messrs. Joseph Cyril Brook (Halifax), and Charles Dennis Wall (Grays).

It was resolved that Mr. John F. Simmance, of London, be nominated for election to Honorary Membership.

The deaths of Mr. A. W. Branson, of West Hartlepool, and Mr. Louis W. Smith, of Leicester, were reported; and the Council's sympathy was suitably expressed.

For the year 1927-28, Mr. Henry D. Madden, of Cardiff, was nominated for election as President; Mr. John Terrace, of London, as Vice-President (the Vice-President remaining in office being Mr. John W. McLusky, of Glasgow); Mr. W. E. Price as Hon. Secretary; and Mr. A. E. Broadberry and Messrs. Wood Drew & Co. as Auditors.

A MEDALLION OF MURDOCH.

The following letter was read from Mr. J. W. Napier, of Alloa:

Walter T. Dunn, Esq.

DEAR MR. DUNN,—I now write to ask your Council's acceptance from me as a gift to the Institution of a Bronze Medallion of William Murdoch, Inventor of Lighting by Gas. The Medallion has been executed by Mr. H. S. Gamley, A.R.S.A., of Edinburgh, and is a reproduction from the original plaster model of the Bronze Medallion placed on the house at Bello-Mill, Lugar, Ayreshire, the birthplace of Murdoch, by the North British Association of Gas Managers in 1913, and unveiled by the late G. R. Hislop, of Paisley.

The Medallion offered, so full of strength of character, is considered by the Artist to be one of his best works, and was exhibited in the Royal Scottish Academy, Edinburgh, at the Exhibition of Works by Scottish Artists a few years ago.

I trust the Council will accept the Medallion, and preserve it as a worthy memorial of a great genius, and of a Scotsman whose inventive talents and labours laid the foundation of the gas industry.

(Signed) J. W. NAPIER.

Gas Department, Alloa,
March 24, 1927.

It was resolved by acclamation that Mr. Napier's gift be accepted with expressions of cordial thanks.

STANDARD SPECIFICATIONS.

Adjourned discussion took place on the standard specification for street lighting proposed by the British Engineering Standards Association. A Committee consisting of Messrs. Francis C. Briggs, C. S. Shapley, and Robert Watson was appointed for the further consideration of the matter.

The report for the year 1926 of the National Illumination Committee of Great Britain, on which the Institution is represented, was received.

Mr. Robert Watson was appointed to represent the Institution at the forthcoming meetings of the Executive and Technical Committees of the International Commission on Illumination to be held at Rome, when the subject of street lighting is to be considered.

Applications so far received to be placed on the list of approved British firms who are prepared to undertake the production of genuine wrought-iron tube strip of British manufacture conforming with the Institution's specification were reported from twelve firms, and were referred to the Wrought-Iron Tubing Committee for consideration.

Approval was expressed of the proposed formation of a Federal Fuel Council representative of all interested in the subject, having for its object the study of fuel problems generally.

An invitation was accepted for the Institution to visit the Shipping Engineering and Machinery Exhibition on Monday, Sept. 12, next.

The reports of the Emergency Committee and of the Finance Committee were accepted and adopted.

After luncheon, at which Mr. Glenister, the Chairman of the Hastings and St. Leonards Gas Company, presided, the Glyne Gap Works of the Company were visited, under the guidance of Mr. Charles F. Botley, the Engineer and General Manager.

ELECTRICITY SUPPLY MEMORANDA.

Now that the campaign for the Wiring of British Homes has officially concluded, we see peeping out from here and there suggestions that this big effort is not immune from a little criticism; and it is thought this will be valuable in connection with any further endeavour in the same line. For example, there was a conference last month at Newcastle, at which some frank statements were made, which conveyed the view of speakers that the campaign had not been an unqualified success. By the way, propaganda of this kind cannot be claimed as having originated with the Electrical Development Association; it was an American innovation. It is also plain that many who have taken part in the expedition for securing the wiring of British homes are not inclined to allow all the kudos to be given to it for recent demand for wiring and appliances. They feel that increases of business have been generated largely by the assisted wiring schemes of municipal authorities, as well as by the coal stoppage. It is also felt that the work has been simply superposed upon the developing labours of electricity supply undertakings in their own areas. Among other comments, it is submitted that the campaign was much too long to sustain the interest of both the public and the contractors. Had the public part of the effort been of shorter duration, it would have been sufficient; while the rest of the time could have been more profitably devoted to preparatory and organization work before the public part was actually entered upon. The small amount of spade work done in the districts before the scheme was publicly floated appears to be its greatest weakness. There should have been larger consultation in each area with the supply undertakings and the contractors; and this, it is felt, would have secured a much better local Press and more adherents to the cause. One speaker at the Newcastle Conference said he thought that good would come from the campaign, which suggests that he has not experienced much from it up to the present. Of course, electrically it has had its gratifying points. For example, it is claimed that the nuclei which have been established—presumably reference is made to the circles founded in various parts of the country—will be valuable for the furtherance of propaganda work. Some fortunate contractors agree that the campaign has had effect in sending-up orders for wiring, lamps, and appliances. A further good report is that it has accomplished excellent success in bringing together the contractors to help in business stimulating work. The demonstration houses are regarded as having been above all successful. That they have attracted a large number of people, we have not the slightest doubt; how many they have converted to the use of electricity, is altogether another matter.

Criticisms of the Wiring Campaign.

Municipal Selling.

There has been a mistaken idea abroad that, under clause 48 of the Electricity Supply Act, 1926, electricity supply authorities are in a position to sell appliances for the use of

electricity at practically any price they like. That this is not so is very clear from the wording of the clause itself, which was agreed to by representatives of all sections of the electricity industry, including the Contractors' Association. In subsection "*c*" of section 2, it is enacted that "The prices charged by a joint electricity authority or a local authority for the sale of any electric fittings shall not be less than the recognized retail prices, unless the sale is to a contractor, in which case the prices shall not be less than the recognized trade prices." If any question shall arise as to what are the recognized retail or trade prices, the question is to be determined by a Committee to be appointed by the Electricity Commissioners. Thus it is seen that local authorities and electricity departments may not dispose of appliances to anyone but those in the trade at prices below the recognized retail ones; and we may be sure that the contractors will keep a sharp watch on the doings in this particular respect of electricity departments. It is explained in an earlier part of the clause that "electric fittings" include electric lights, fittings, apparatus, and appliances for lighting, heating, and motive power, and for all other purposes for which electricity can or may be used.

Spring Cleaning. Much drummed into the ears of the public has been the assertion that there is no dirt arising from electrical operation and no smell from cooking; that houses through the use of electricity retain an unblemished state of purity. There are, at this time of spring cleaning, singular contradictions to these statements. Boldly the electricians now confess that even all-electrically operated houses have to undergo spring-cleaning. They are genuinely opportunists of the first water. They are advertising electric vacuum cleaners, and other labour-saving devices, for assisting in the spring-cleaning, which shows what jocular fellows, with an eye on the main chance, our electrical rivals can be. At one time a statement was brandished about that from electric ovens there is no smell; but just recently there has been the admission that unclean ovens of any description do smell, and that cooking foods, particularly vegetables, have an odour of their own which no heating agent—not even the pretender electricity—can convert into a beautiful smell.

The "Poor Man's Light." Lately there has been a revival of interest in the subject of "fixed price" lighting schemes for small consumers. As we have frequently pointed out, this fixed price business almost invariably ends in the revelation to those who adopt it that fixed prices and uncontrolled consumption are inimical, and generally result in a condition which is against the interests of the undertaking. In "The Electrical Times" for April 7, Mr. J. G. Williams, the Engineer and Manager of the electricity undertaking at Erith, states: "We have had a fixed price lighting scheme for small consumers since 1911. In our case, the system has not worked out altogether satisfactorily, and we are not extending it." It is the old, old story.

Mishaps. On April 6, an inquest was held at Oldham on Joseph Gill, who was electrocuted the previous Monday, evidently through amateur work in connection with additions to a lighting installation which had been made without notifying the Corporation Electricity Department. According to the Mains Superintendent, a control switch had been put on a neutral line instead of a live line, and this meant that the socket in which the plug was placed was always alive, even when the switch was off. The voltage was 230. Recently a labourer named John Higham, of Warrington, was electrocuted at the tannery of Messrs. S. Reynolds & Co., of Latchford. He was engaged in changing an electric lamp when a current of 250 volts passed through him. Ambulance men tried to restore him; but he died almost immediately. Among recent failures of electricity, one is reported from Staveley, Derbyshire. At the time of the collapse a doctor was performing an operation on a patient's throat, and it had to be completed by candle light. On two occasions, during mission services at the Bonnethill U.F. Church Hall, Dundee, according to reports in the "Dundee Advertiser" for April 5 and 6, the electric light failed, and the audience was left in darkness. We cannot vouch for the veracity of the reporter in our contemporary; but he asserts that just before the first failure the hymn "Send the Light" had been sung. A black mark will be set against a reporter in the "Glasgow Herald" who has never read of the great innocence (*vide* our electrical contemporaries) of electricity in the matter of fire-raising. A serious fire occurred in the mansion of Lawers, two miles east of Comrie. The fire, it is stated, originated in the centre portion of the house; and the reporter states it is "supposed to have been caused by an electric fusion." At a fire at Bradford in a large block of buildings in Manor Row (the damage occasioned by which is roughly estimated at £100,000), it is stated that one of the firemen, named Farley, received an electric shock, which necessitated his treatment at the Royal Infirmary.

Private Generation of Power. In this country little is known as to the extent of the production of electricity by private plants. Occasionally figures are put forward which are more or less guesswork. The generation of electricity by private plants, could the aggregate be ascertained, would naturally make a great difference in the upward direction to the figures (which are quoted from time to time by the Electricity Commissioners and others) showing the average utilization of electrical energy per head of the population. Even the census reports on various trades do not give any correct idea of the extent of private generation, inasmuch as the statistics only include certain industries, and do not take into account those considerable installations which there are in many large trading establishments, hotels, theatres, kinemas, and other places. However, the census reports relating to 1924 (which are confined to Great Britain) include figures for various industries which will be found interesting. At blast-furnaces, it is recorded, there are in use motors aggregating 106,563 H.P., all of which are operated by electricity generated by engines on the works. Purchased electricity is only used with motors having a total capacity of 33,067 H.P. For smelting, rolling, and founding, motors are in use aggregating 445,365 H.P., the electricity for which is generated by engines *in situ*, while electric motors representing a total of 475,850 H.P. are driven by purchased electricity. In the wrought-iron and steel tubing trade, motors equal to 16,836 H.P. are driven by electricity home generated; while motors of 71,458 H.P. are actuated by purchased energy. The tinplate trade use electric motors aggregating 10,003 H.P., supplied by engines on the establishments; while electricity is purchased to drive motors totalling 4991 H.P. In the cotton trades, the total energy used is 109,512 KW., of which 80,092 KW. is provided by steam-engines, 25,545 KW. by steam turbines, and 3875 KW. by other power. The motors driven by electricity generated in cotton factories is returned as 128,506 H.P., while 176,959 H.P. is provided by purchased electricity.

Other Trades. Turning to the boot and shoe trades, in 1924 motors aggregating 3401 H.P. were driven by privately generated energy; and, in addition, there were motors equal to 32,519 H.P. driven by purchased energy. In the rubber trade, the motors actuated by energy generated by factory engines represented 36,747 H.P., while motors totalling 56,238 H.P. were driven by purchased current. The paints, colours, and varnish trades had motors driven by purchased electricity amounting to 23,568 H.P., while motors equal to 2863 H.P. were driven by electricity privately generated. The grain milling trades had driven by purchased electricity motors equal to 55,084 H.P.; while motors aggregating 13,437 H.P. were driven by electricity generated by private engines. In the sugar and glucose trades, motors totalling 3489 H.P. were driven by purchased electricity; while motors representing 30,394 H.P. were operated by electricity privately generated. The spirit distilling trade utilized motors driven by purchased current aggregating 3022 H.P.; while electric generators on the works had a total capacity of 5041 KW.—the motors driven by these representing 6106 H.P. The spirit compounding, rectifying, and methylating trade employed motors equal to 307 H.P., driven by purchased electricity; while only 44 H.P. of motors were driven by electricity generated in the factories. The tobacco trade used electric motors driven by purchased electricity to the extent of 9485 H.P., while electricity privately generated supplied 2279 H.P. In coal mining, electric generators driven by the collieries' own engines had an aggregate capacity of 778,363 KW. The electric motors driven by home-generated electricity were equal to 1,030,139 H.P.; and motors driven by purchased electricity, 538,221 H.P. In the coke and bye-products fields, electric generators represented 37,264 KW.—the motors driven amounting to 18,936 H.P.; while those driven by purchased electricity totalled 50,107 H.P. The manufactured fuel trades employed electric generators of a capacity of 2983 KW.—the motors driven by these being 3861 H.P.; while those driven by purchased electricity equalled 1664 H.P. In the railway carriage and wagon building trade, electric generators had a capacity of 15,207 KW.—the motors driven by the energy from these amounting to 20,590 H.P.; and the motors driven by purchased electricity, to 41,916 H.P. In the motor and cycle trades, the electric generators had an aggregate capacity of 25,010 KW.; the motors driven by these representing 29,595 H.P., while those operated by purchased electricity equalled 142,101 H.P. In the seed-crushing trade, the electric generators had a capacity of 15,625 KW.—the motors driven being equal to 17,977 H.P.; and those driven by purchased electricity, 22,987 H.P. The soap and candle trades possessed electric generators aggregating 18,396 KW.—motors driven being equal to 10,110 KW.; and those operated by purchased electricity, 9855 KW.

Visit of Ceramic Society to Czecho-Slovakia.—On Saturday, April 30, the Society will leave London for a tour in Czecho-Slovakia, returning on either May 14 or May 16.

JOINT BENZOLE RESEARCH COMMITTEE.*

Review by Dr. W. B. DAVIDSON of the Fourth Report.

One is now accustomed to look forward year by year to the issue of a record of sound, honest research work carried out by the able chemists of the Benzole Joint Committee, a Committee which comprises men eminently qualified for giving the best possible direction to the work of investigation. One does not look for startling discoveries or revolutionary ideas resulting from work of this kind. These invariably come from pioneering outsiders, who naturally have axes to grind. One is not inclined to blame inventors for wishing to recoup themselves for labour and expenditure attending the launching of a new adventure. On the other hand, however, one invariably finds gross exaggeration to be a chief characteristic of the advertised merits of new processes, with a studious concealment of their defects. For this reason the testing and appraisement of new substances and methods by an independent impartial authority is of immense value to industry, in that great waste of money is avoided.

In the three annual reports already issued, the aim of the Committee has been to give an account of the investigation of methods used or suggested for the recovery or refining of benzole—methods making for an increase of output, reduction of loss, or greater economy. The work of the past year, embodied in the present report, is centred on a particular problem which is of first importance to all concerned with the production of motor spirit; and especially to those engaged in recovering it from processes of low or high temperature carbonization, or of oil cracking.

The question which has had to be critically studied is one involving the specification of a good motor spirit. This specification must not be unnecessarily severe, if economy of production and refining is to receive encouragement. For example, it is now generally agreed that the presence of unsaturated liquid hydrocarbons in a motor spirit is not likely to do harm unless these constituents become responsible for resinification in storage or in use. Their fuel value is high, and, moreover, their "anti-knock" properties specially recommend them.

The present report is thus mainly concerned with "Resin Formation in Benzoles;" the subject matter being subdivided as follows:

Part I.—Causes and Elimination of Resin Formation in Engines from Unrefined Benzoles.
Part II.—The Treatment of Benzoles with Adsorbents.
Part III.—Resinification of Benzoles on Storage.
Part IV.—The Action of Adsorbents on Benzene Solutions of Free Sulphur and Organic Sulphur Compounds.
Appendix I.—Estimation of Unsaturated Constituents in Benzoles.
Appendix II.—Tests for Detecting Phenols in Crude Benzoles.

Part I.—It is interesting to learn that "an examination of a large number of unwashed benzoles has shown that there is no proportionality between the amount of unsaturateds present and the stability of benzoles." The fact that freshly distilled benzoles and "cracked" petrols containing considerable quantities of unsaturateds have apparently proved satisfactory in use as motor spirit leads to a suggestion that is made that resinifying could be avoided to some extent by storing more "once-run distillate" and less finished product.

Prevention of resinification by addition of substances to crude freshly-distilled benzoles appears to the Committee to be a promising line of investigation for the current year. It is shown that it is possible to retard or prevent ("inhibit") resin formation by the addition of small quantities of certain substances. It is pointed out in the General Introduction, p. 8, that phenolic bodies have this inhibiting effect. For example, it was found in many cases that the complete removal, by soda washing, of the acidic (phenolic) constituents gave a refined product which, strange to say, was more subject to the trouble of resin formation than the partially purified, or even the once-run, distillate.

The reviewer would point out that this is on a par with the action of similar bodies in inhibiting sludge formation in the use of electric transformer and switch oils. The most useful substances appear to be mild organic reducing agents such as those employed as developers in photography.

Part II.—Consideration is given to the numerous substances which are in use as adsorbents in the petrol industry, such as bone and vegetable charcoal, bauxite, floridin, fuller's earth, clays, inorganic gels, &c. Treatment at room temperature by filtration has been investigated experimentally at considerable length, in order to observe the following behaviour of benzoles: (1) Removal of dissolved resin from a benzole free from unsaturateds. (2) The effect of filtering a benzole containing unsaturateds through an adsorbent. (3) Alteration in stability produced by partially resinifying and removing the unsaturateds. (4) Tendency of adsorbents to remove substances inhibiting resin formation.

The absence of a satisfactory test for the determination of the actual proportion of unsaturateds in a mixture of hydrocarbons prevents accuracy of comparison. Furthermore, there are as yet no satisfactory standard tests for stability. The comparative method of determining unsaturateds is, as before, washing with 8 p.ct. (by volume) of 95 p.ct. sulphuric acid. Exposure to ultra-violet light for a comparatively short period promises to be the basis of a satisfactory test which may be specified in the future for indicating the tendency of a sample of benzole to resinify.

Other important conclusions that may be noted are: (1) Resinous matter can be produced by treatment with adsorbents; and this can be separated. (2) Unsaturateds cannot as yet be differentiated into those that are unstable, causing resinification, and those that are stable. (3) Though the proportion of unsaturateds may be reduced, the resulting benzole is in many cases less stable to light after treatment. In the tests carried out, no benzoles were found containing fairly large proportions of unsaturateds the stability of which was appreciably increased by treatment with adsorbents.

Part III.—This constitutes the greater portion of the report, and includes a careful discussion and experimental study of such subjects as (briefly): The action of light on unrefined benzoles; the action of ultra-violet light on benzoles and on benzene, toluene, and xylene; reactions involved in resin formation; influence of water on resinification; correlation of the quantities of resin formed in glass vessels and tin vessels in the dark and under ultra-violet light; investigation of the various factors on which resinification of benzoles depends (*a*) in glass vessels, (*b*) in copper and other metals; the oxidation of crude benzoles by atmospheric oxygen, and the effect of inhibitors on the rate of oxygen absorption; theories of the action of inhibitors; "gumming tests." The mere enumeration of the above is sufficient to indicate the immense scope of the work involved, and the enormous amount of reading and study self-imposed upon the investigators. As far as one can see, this work has been done in the meritorious fashion that has so far characterized the Committee's researches; and yet the respective subjects are so difficult that in most cases no finality can be said to have been reached, though there are many valuable conclusions of a negative character.

Only one inhibitor (tricresol) has been thoroughly experimented with; and it is clear there is a wide field for further research on other possible inhibitors.

The ideal properties of a satisfactory inhibitor are laid down as follows: (1) A very small amount necessary. (2) Soluble in benzoles. (3) Sufficiently volatile to vaporize with the benzole. (4) Not forming non-volatile compounds. (5) No effect on metal contained or parts of engine. (6) No discoloration, nor retarding of combustion. (7) Inexpensive.

With regard to the ultra-violet lamp test, reference is made to the difficulty in standardization. Having had some experience in this matter, the reviewer is able to appreciate this point fully. Were direct electric current generally available, the quartz mercury-vapour lamp would meet the case completely, one would say. It becomes a costly business when one has to convert alternating into direct current.

Part IV.—"Determination of Total Sulphur in Benzoles" is the subject of the first portion of this section. An illustration and description of a simple apparatus for the quick determination of sulphur is given (p. 193), consisting of a burette terminating in a bent capillary carrying a tiny upright burner consisting of a piece of asbestos tape and a silica sleeve. The benzole is mixed with a definite volume of sulphur-free alcohol, for the purpose of burning, and the products are scrubbed with neutralized hydrogen peroxide solution with the aid of a water pump.

The second portion is devoted to a study of the action of iron oxide gel, silica gel, and bauxite on benzene solutions of carbon disulphide, ethyl disulphide, thiophene, and free sulphur. The results are mainly negative. For example, no useful reduction in the content of free sulphur was observed even with iron oxide gel where some chemical attraction might have been expected.

Appendix I. deals with "Tests for the Estimation of Unsaturateds in Benzoles." It is stated that until a great deal more is known regarding the actual nature of the unsaturated compounds present in benzoles, any method of estimation will be more or less empirical; and this is no doubt correct.

Appendix II. has for its subject: "Tests for Detecting Phenols in Crude Benzoles, &c."

The bibliography with which the volume finishes is an amazing commentary on the enormous amount of work now in progress connected with the subject of motor spirit. First of all there are 25 papers relating to unsaturated hydrocarbons. Then for the year 1926 there are 20 articles on sources of benzene, &c.; 41 dealing with recovery by oil washing; 24 on

* Fourth Report of the Joint Benzole Research Committee of the National Benzole Association and the University of Leeds; pp. 248. Presented March 16, 1927. Copyright of the National Benzole Association.

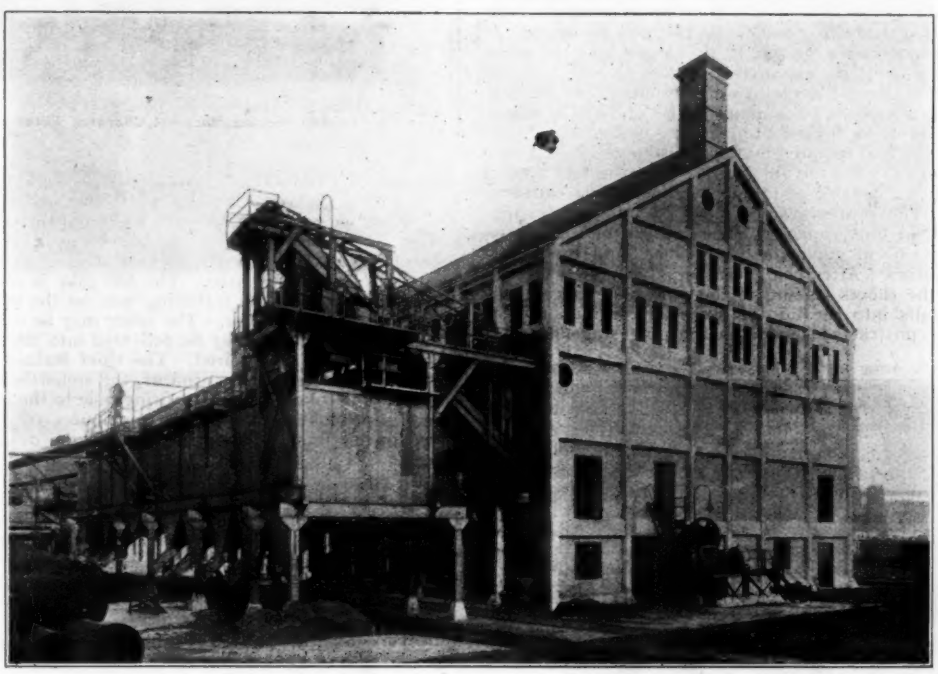
recovery by solid adsorbents; 33 on the manufacture of active carbon; 8 on the manufacture of gels, &c.; and 28 theoretical papers on adsorbents. There are 32 papers on chemical methods of refining; 25 on physical methods of refining; 53 on analysis; 19 on physical and chemical properties of hydrocarbons; 96 on uses, &c.; 39 on cracked petrols, &c.; 6 on autoxidation and catalysis; and, finally, 14 references to gas purification, &c.

The mere enumeration of this total of 463 papers, patents, &c., culled with great pains from all existing scientific journals and books, occupies 27 pages of the volume. They are practically all for the year 1926, and form a valuable, if formidable, list of literature on the all-important subject of motor spirit.

Certainly one cannot but admire the scrupulous care and thoroughness with which the Joint Benzole Research Committee (composed of representatives of the National Benzole Association and of the University of Leeds) continue to carry out their highly important work; and one certainly realizes that the praise they bestow on the chemists associated with the work is fully merited.

NEW CARBONIZING PLANT AT CROYDON.

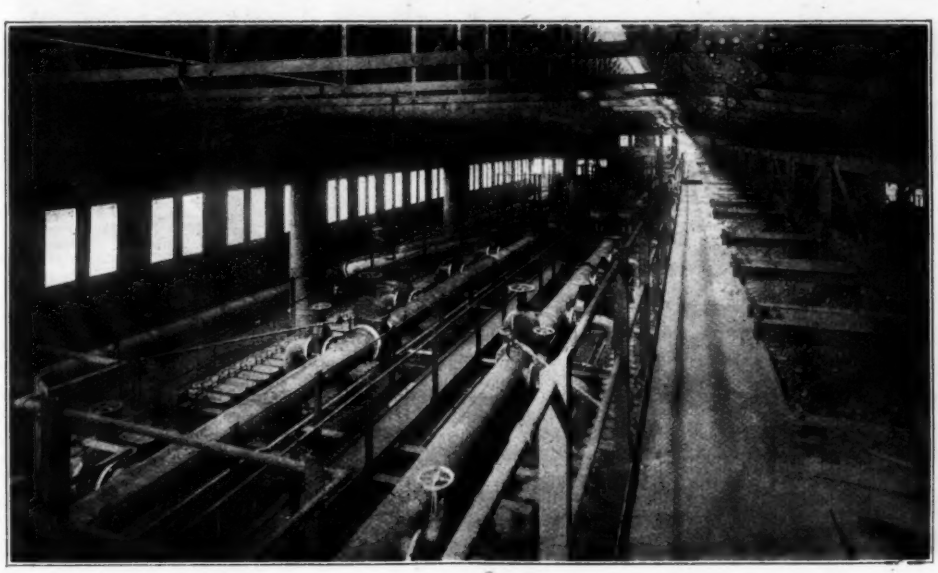
[Extracts from an article in the "Croydon Co-Partner," to which we are also indebted for the illustrations.]



SOUTH GABLE—DRIVING END OF R.H. CONVEYOR; COKE STORAGE HOPPERS.

By the courtesy of Mr. A. Caddick, the Engineer, we are enabled to give, from the Croydon Gas Company's "Co-Partner" Magazine, the following description of the new retort-house at the Waddon Works, which is capable of carbonizing about 200 tons of coal and making approximately 2½ million c.ft. of gas per diem—a considerable increase to the manufacturing capacity.

No. 4 retort house, the construction of which was commenced in the summer of 1925, and was completed last year, has recently been put to work. It is believed to be of novel construction, forms an imposing addition to the works, and is a pleasing feature as seen from the adjoining Wandle Park and surrounding district. The dimensions of the building are about 210 ft. long, 72 ft. wide, 46 ft. to the eaves, and a total over-all height of over 70 ft., excluding the chimneys. It is constructed of rolled steel joist framing encased in expanded metal and moulded in concrete; the panels being filled-in with expanded metal sheets, and concreted to a thickness of 3 in. only; openings being formed for doorways, light, and ventilation. The

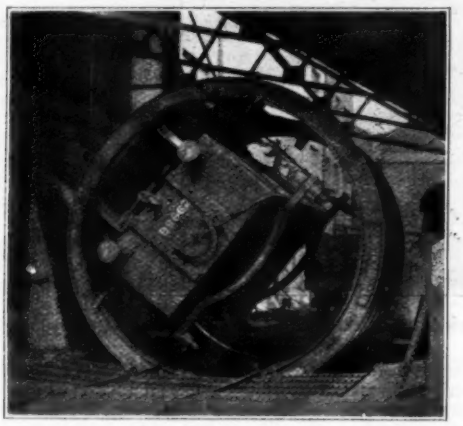


GAS COLLECTING MAINS; GOVERNORS; COAL CONVEYORS TO STORAGE HOPPERS.

huge exterior surface is therefore broken up into a series of panels, and generally has the appearance of being a legitimate reinforced concrete building. The roof is slated; and at the apex is an open ventilator continuous from end to end. There are two benches of retorts, one of eight settings and the other of seven settings; each setting containing ten through retorts, or a total of 150 retorts. The main flue from each bench discharges at one end to its chimney, 81 ft. high, or in the reverse direction to the main flue leading to the waste-heat boilers (referred to later); dampers being arranged at each end of the flue. The settings are Drakes latest patented tubular regenerators, with step-grate furnaces on one side only—one furnace to each setting. The ten retorts are each 22 in. by 16 in. by 20 ft. through ⊓ shaped, built in five tiers. The ends of the retorts are fitted with cast-iron sockets, to which the mouthpieces are bolted. Each mouthpiece is fitted with an adjustable self-sealing lid, and has an ascension pipe for taking-off the gas. The latter passes to the hydraulic mains, and thence by collecting mains to the governors, of which there are two to each bench, so arranged that either one or the two may be worked at will. From the governors the gas is discharged into the main outlet from the house to the exhausters.

The hydraulic mains are made in separate units, one to each set of ten ascension pipes. Each main can be adjusted to maintain the correct levels of the seals to the dip pipes.

The whole of the coal required by this house is received direct from railway wagons; and for unloading, a Bennis rotary tippler is installed. This is capable of taking wagons of any capacity up to 20 tons. The contents are discharged into a receiving hopper of about 40 tons capacity. The crusher pit, which is 26 ft. deep, contains in duplicate the crushers and the lower part of the elevators. After being crushed, the coal is raised about 80 ft. to the shoots leading to the push-plate conveyors, from which it falls into the line of overhead continuous coal storage hoppers constructed above the charging stage floor of the house. The total storage capacity is about 300 tons, equal to 36 hours' supply. Electrically driven capstans are arranged for the haulage of the wagons to and from the tippler.



Bennis Rotary Tippler.

Drakes Stoking Machine, Charging Rotor Side.

The retorts are charged and discharged by Drakes latest type of electrically driven combined stoking machine operated and controlled by one man. The hot coke is received through a patent (No. 15117/26) travelling bus, on the bottom of which is fitted a revolving shoot. The latter may be rotated in such a manner that the coke may be delivered into the furnaces or on to the conveyor, as required. The chief feature of this design is that, when feeding the furnaces, the stoker is able to see into and poke the coke through the firing hole to the best advantage. There is no doubt that the bus contributes very largely to the reduction of time and arduous work in the discharging of the retorts.

The coke is taken away by a "Croydon" pattern De Brouwer conveyor running the full length of the retort house. On its way it is quenched by water at 60 lbs. pressure from jets and hose pipes. It is then delivered to a transverse inclined conveyor, by which it is taken outside the house, and is elevated to "Croydon" vibrating screening conveyors. These are arranged in duplicate along the top of the storage hoppers. "Croydon" coke-cutting machines are provided in duplicate. The coke conveyors travel at a speed of 40 ft. per minute, and the screening conveyors at 400 R.P.M., giving a coke-travel of 50 ft. per minute. The bottoms of the storage hoppers are provided with outlets controlled by slides, by means of which railway wagons or motor lorries passing beneath may be filled. Along one side shoots are arranged for the filling of sacks, &c. Each of these shoots is provided with a perforated grating bottom, so that the last traces of dust are eliminated before the coke enters the sacks.

The whole of the electric motors driving the stoking machine, rotary tippler, and coal and coke plants are totally enclosed, and

PATENT COKE BUS; COKE CONVEYORS; WASTE-HEAT BOILERS.

SPENCER-BONECOURT WASTE-HEAT BOILERS.

Transverse Elevating Conveyor—Coke Screening Conveyors.

therefore dust and water proof. They were manufactured by the British Thomson-Houston Company. The power supply is direct current, 220 volts; and a feature of the whole plant is the low consumption, which for all purposes, exclusive of the waste-heat boilers, is under 4 B.O.T. units per ton of coal carbonized.

The main contractors for the retort house, including iron and steel work, retort settings and mountings, stoking machine, coal and coke handling plants, &c., were Messrs. Drakes, Ltd., of Halifax, who carried out their contract in a most satisfactory manner. Waste heat from the settings is taken to a steel-cased insulated, firebrick lined flue, built between the two benches, leading to two Spencer-Bonecourt boilers, each of which has an evaporative capacity of about 4500 lbs. of steam per hour at a pressure of 120 lbs. per sq. in.

There are two "Permutit" water-softening plants, each of a capacity of 600 gallons per hour, arranged in duplicate. Provision is made for the comfort of those co-partners whose duty it is to operate the plant. There is a small mess-room, with the necessary washing accommodation.

FORTHCOMING ENGAGEMENTS.

April 22.—London and Southern District Junior Gas Association.—Meeting at the Westminster Technical Institute at 7.30. Paper by Mr. E. C. Holt entitled "Recent Improvements in Dry Meters."

April 23.—Yorkshire Junior Gas Association.—Meeting at Huddersfield. Paper by Mr. B. Thorpe. Visit to the Huddersfield Gas-Works.

April 23.—Scottish Junior Gas Association (Western District).—Visit to the Dundee Gas-Works.

April 23.—Scottish Junior Gas Association (Eastern District).—Visit to the Kirkcaldy Gas-Works.

April 27.—Southern Association of Gas Engineers and Managers (Eastern District).—Meeting at Ramsgate.

April 30.—Wales and Monmouthshire Junior Gas Association.—Annual meeting at Newport.

May 4.—Manchester and District Junior Gas Association.—Visit to Donnington Works of C. & W. Walker, Ltd.

May 5.—Eastern Counties Gas Managers' Association.—Spring meeting at Ipswich.

May 5.—North of England Gas Managers' Association.—Annual meeting at Newcastle.

May 6.—London and Southern District Junior Gas Association.—Annual business meeting at the Westminster Technical Institute at 7.30.

May 7.—Midland Junior Gas Association.—Visit to the Foleshill Works of the Coventry Gas Department.

May 10.—Federation of Gas Employers.—Meeting.

May 10.—National Gas Council.—Meeting.

May 12.—Midland Junior Gas Association.—Annual meeting.

May 19.—Wales and Monmouthshire District Institution of Gas Engineers and Managers.—Meeting at Abergavenny.

May 20.—British Commercial Gas Association.—Manchester District Conference at Buxton.

May 20.—Southern Association of Gas Engineers and Managers.—Visit to the Nine Elms Works of the Gas Light and Coke Company.

May 21.—Yorkshire Junior Gas Association.—Visit to the Keighley Gas-Works.

May 21.—Scottish Junior Gas Association (Eastern District).—Annual meeting in Edinburgh. Presidential address of Mr. M. Darling, of Cowdenbeath.

May 25.—Evening Star Lodge.—Meeting.

May 26.—Midland Association of Gas Engineers and Managers.—Spring meeting at Dudley.

May 26.—Society of British Gas Industries.—Annual general meeting and dinner, at the Hotel Cecil.

June 11.—London and Southern District Junior Gas Association.—Visit to the Margate Works of the Isle of Thanet Gas Light and Coke Company.

July 12.—National Gas Council.—Annual meeting.

Sept. 23.—Southern Association of Gas Engineers and Managers.—Visit to the Torquay Works of the Torquay and Paignton Gas Company.

Institution of Gas Engineers.

May 9.—Emergency and Finance Committees.
May 10.—Advisory Committee on Education.
June 13.—Council meeting.
June 14-17.—Annual General Meeting in London.

GERMAN COKE OVEN GAS SCHEME.

Brown Coal Claims Participation.

In our issue for March 30, we gave a short account of a scheme which is being propounded in Germany for supplying practically the whole country with coke oven gas from the coal districts. The previous account was from gas industry sources. The following further particulars give, among others, the viewpoint of the coal-owning sponsors of this revolutionary project.

A meeting in Berlin of the Standing Technical Fuel Committee of the Government Coal Council on Jan. 25 was addressed by representatives of various parties interested in the scheme. An official shorthand note, just to hand, was published in "Das Gas- und Wasserfach" for March 26. The following particulars are taken from this, and from previous numbers in which reference was made to some of the speeches.

The Promoters' Point of View.

This was explained by Dr. Pott, a representative of the syndicate which has been formed by the powerful Ruhr heavy industries to foster the scheme. There is no intention, he said, of injuring any of the other coalfields in any way, or of cutting them out by the gas supply from the Ruhr. The system of mains at present planned is as follows: Ruhr-Berlin; Ruhr to the coast; Ruhr-Cassel; Leipzig-Berlin; Leipzig-Cassel; Silesia-Berlin; Silesia-Saxony; Central Germany-Munich; and Cologne-Mannheim-Stuttgart. This, it is claimed, follows the present general lines of coal movements, and has, as its main centres, the various coalfields. The mains would, therefore, be available for them, on the same terms, as soon as they were developed to the same degree of readiness to supply gas as the Ruhr now is.

It is not practicable, said Dr. Pott, and is certainly not intended, that gas-works, which are at present producing economically, should in every case be shut-down, and substituted by high-pressure supply. The two systems must live together, and the choice be considered upon the economic and social circumstances of each individual centre, just as is the case already with regard to electricity supplies. It is not suggested that each town should be dependent upon one direct line. The scheme aims rather at a whole series of interconnected mains. For example, Berlin might be the radiating centre of five different lines from various sources of supply, all connected-up one with another.

Cost and Selling Price.

It is not right to say that high-pressure coke oven gas supply is proof against competition. It is true that, if proper provision be made for interest on capital in estimating the cost of gas-works gas, it will, in almost every case, be higher than that at which coke-ovens could supply. Only in the case of very distant centres, badly served, and of low consumption, can even the most modern gas-works compete as regards price. But the speaker stressed the great advantage of the elasticity of the proposed supply, especially in Germany, where the gas-works are practically all municipally owned, and the financing of replacements and enlargements is apt to lead to complications.

The producers of the gas would have no say in the matter of the price charged to the ultimate consumer. They would merely sell in bulk to the municipality. Prices should, however, be capable of rapid reduction. The bogey of increasing coke stocks with increased demand for gas would be instantly removed, and the authorities would have every inducement to push the sales of gas as hard as possible. In this way, administration and distribution costs, which at present amount to between one-third and two-thirds of the total selling price of the gas, would be reduced.

Financial Considerations.

No direct financial interest ought to be taken by the municipalities in the coke-ovens. It is the avoidance of fresh capital expenditure which should be one of the chief attractions of the scheme to them. Apart from this, participation could not be confined merely to coke ovens, as their finances are inextricably bound up with those of the coal, iron, and steel industries. The question as to joint ownership and working of the pipelines would have to be discussed. At any rate there would have to be a clear legal ruling on the wayleave question, so that there could be no possibility of the blocking of one whole district by another dissenting one.

The Coal Council, which is representative of all possible interests, already has powers to regulate maximum coal and coke prices. This, in turn, would regulate gas prices *ex* coke ovens, which would be based not upon a fixed monetary rate, but on the equivalent of a fixed weight of marketable coal. Gas prices would, therefore, vary with the open market value of coal. Coke prices would be regulated in the same way, quite apart from the fact that the coke ovens would be open to competition from outlying gas-coke producers, as well as from the import of English coke.

Dr. Pott concluded his remarks with a comparison between the suggested high-pressure gas supply and the already existent distribution of electricity over large areas at high tension, which claims to confer great benefits on the people. He maintained that it would be of the greatest advantage to the nation, as constituting the most economical method for utilizing coal, of which every citizen is either a direct or an indirect consumer.

Gas from Brown Coal.

Large quantities of brown coal are, of course, available in Germany, but its limitations for gas production by ordinary distillation methods were fully proved during the war and post-war shortage of gas coals. That the brown coal interests are giving full support to the principle of centralized gas supply by colliery interests was made evident at the meeting by two of their representatives, Dr. Bube and Prof. Seidenschnur—provided, of course, that they are included as suppliers of gas. By new processes which are already in an advanced stage of development, the industry is prepared to supply large quantities of gas of the same quality as that obtained from bituminous coal. According to such processes, the coal is first treated for the extraction of the tar, which is accomplished without the formation of any great quantity of combustible gases. The resultant semi-coke is rich in volatile constituents, which are readily convertible into gas equal in calorific value and specific gravity to that which the Ruhr coke ovens propose to distribute. As much as 300 cub.m. [10,600 c.ft.] of gas can be produced per ton of brown coal; still leaving a coke of "easily disposable" quality. By treating in this way only one-tenth of the present total output, Dr. Bube can visualize the supply of a very large area of central Germany with brown coal gas, thus eliminating any necessity for long costly mains from the Ruhr to such places as Leipzig and Dresden. Incidentally, the brown coal deposits could cater for Berlin, Magdeburg, Hanover, Hamburg, and Bremen, to mention only a few big cities! The speaker concluded by pointing out that the one raw material which Germany possesses in abundance is coal, and she must therefore make the utmost use of it in the world's markets. In his opinion, the suggested partition of the country's gas supply between the Ruhr and the brown coal interests would be a tremendous step in this direction.

A Reply from the Gas Industry.

Herr Lempelius, who holds a foremost position in the gas industry, and is Editor of our contemporary, "Das Gas- und Wasserfach," was called upon by the Chairman to state his views on the subject. He heartily agreed with Dr. Pott upon one question. There can be no doubt, he said, that the future of gas supply is bound up with centralization and high-pressure distribution, but whether the source is to be the Ruhr mines, or brown coal, or super gas-works remains to be seen. Now that the other parties had shown their hands, he urged the fullest possible inquiry into all the aspects, for which the complete organization of the gas industry was prepared at any time.

He uttered a warning on two subjects, on which there is danger of exaggerated expectations. He does not think there is any hope of ever attaining the same gas consumption per head of population in Germany as in other countries, especially England and the United States. The conditions of life are so totally different. There is also a great deal of talk about the dawning of an era of cheap gas, if once the great Ruhr scheme can be introduced. But where the possibility exists of any material cheapening of gas to the general consumer, he cannot see. He called attention to a noteworthy absence of definite figures from the exposition of Dr. Pott and his colleagues. It is to be hoped that the country will not fall between the two stools of the rival schemes of the brown coal industry and the Ruhr, or go hungry like the donkey in the fable which could not decide between the attractions of two bundles of hay.

A Lack of Facts and Figures.

Herr Francke, another representative of the gas industry, called attention also to the absence of definite data in the proposals put forward, which is giving rise to extraordinary rumours of impossibly cheap gas. In Berlin, for instance, where output is large, and distribution and general costs consequently favourable, he does not think there is the slightest prospect of cheaper gas by taking supplies from the Ruhr or elsewhere. The cost of transport of one calorie by pipeline is twice to two-and-a-half times as great as by railway, even under the most favourable conditions, and the cost of water transport is only half that of rail. Considering these figures, there must surely be a limit to the economic radius of centralized gas supply.

Another speaker, Herr Wagner, raised the point as to whether England would stand by and see herself shut out of the North German market without taking counter measures in

other directions which would be seriously inimical to German industry.

A Long Contract Essential.

In general reply to the discussion, Dr. Pott emphasized the grave responsibilities which a gas supply contract would involve. The Ruhr interests have 16 years' experience, and are now already delivering 300 million cub.m., but before embarking on the larger scheme they would have to have the assurance of at least a 30-year contract. In the case of the Ruhr mines, their costs would be based on the world price of coal, and the value of the gaseous calorie could never, in the natural course, be less than that of the calorie in coal form. But he warned the brown coal interests that it would be a very different risk fixing a long contract based on the future value of their oil products.

GERMAN GAS-WORKS AND THEIR COAL SUPPLIES.

A correspondent has kindly sent us a cutting from the authoritative German newspaper, the "Vossische Zeitung" of April 6, which is particularly interesting when considered in conjunction with the much-discussed proposals of the Ruhr coal interests that the gas supply of practically the whole country should be centralized at their coke-ovens. The translation is as follows:

Against the Coal Syndicate.

We learn on reliable authority that the cities of Frankfort and Cologne are jointly engaged in negotiations, which promise success, for the acquisition of a coal area in the Ruhr district which has not yet been worked. Their object would be to develop it themselves, and so ensure supplies for their gas-works from their own pits. There is a possibility also of a participation by Düsseldorf in the impending deal. The project is a large one, and would involve a sum of about 100 million marks [some £5,000,000]. There is no intention of developing it on centralized high-pressure supply lines; the object is rather to gain independence from the present monopoly of the Rhine-Westphalian Coal Syndicate and their price policy. It is said that the Rheinische Stahlwerke Company are the other party to the proposed sale; and, if it materializes, it will mean a profit to them of 14 million marks. A total of 325 million tons of coal is mentioned as being involved.

METHODS OF ANALYSIS OF COAL.*

Reviewed by M. Barash, M.Sc., A.I.C.

This report supersedes Survey Paper No. 2, the now well-known "Interim Report on Methods of Analysis of Coal," published in 1923. Just as the Interim Report proved extremely useful to fuel technologists, there is no doubt that this new publication will prove a valuable asset in the laboratory of the chemist who is concerned with the analysis of coal. The functions which it is intended to serve are best summarized by quoting the following abstract from the prefatory note on p. iii.

> In the past there have been no standard methods of analysis, and different investigators have adopted variations of procedure, which have led to variations in results. In consequence, analyses done by different observers are not always comparable, and, in the absence of information as to the exact methods adopted in each case, may even be misleading. In order to ensure that the results of examinations of coal made for the purposes of the survey should not suffer from any such uncertainty, the methods of analysis now described have been adopted by the Department of Scientific and Industrial Research for the purposes of its work on coal; and it is hoped that they will be adopted generally by analysts throughout the country, so that all results may be strictly comparable.

The latter observation, referring to analysts outside the Department, should be particularly stressed. It would certainly be desirable to extend this even further; and considerable benefit would no doubt accrue if some measure of co-operation were established with fuel technologists and associations beyond our shores for the purpose of an international standardization of methods of coal analysis.

The methods recommended in the present issue differ but slightly from those given in the Interim Report, and, fortunately for those who adopt them, will not necessitate any comprehensive change in apparatus or in procedure in order to comply with all the details of the determinations.

The method given for the determination of moisture is unaltered. In the determination of ash, a simple test is advised in order to ascertain if complete combustion has taken place. For the determination of volatile matter, the usual "platinum crucible" method is again recommended, but it is now stated that silica or porcelain crucibles of suitable shape may be substituted for platinum without seriously affecting the results, provided the heating is carried out in a muffle furnace. There are no noteworthy changes in the methods advised for the ultimate analysis of coal (determination of carbon, hydrogen, sulphur, nitrogen, and oxygen). It is thus remarkable to find the Eschka method still recommended for the determination of sulphur, though doubt is cast upon its reliability, particularly in the case of coals containing more than 2 p.ct. of sulphur, and though a simpler, quicker, and more reliable method is readily available. This latter will be referred to later.

Due regard is again paid to the determination of phosphorus in coal ash—important in cases where the coal is to be used for metallurgical purposes—and valuable information has been added, as Appendix II., on "Abnormalities in Phosphorus Determinations," wherein is discussed the possible influence of the presence of arsenic, silica, titanium, and vanadium on the determination. The precautions to be adopted in order to eliminate such interference are detailed.

The Gray method for the determination of the so-called "Caking Index" or "Caking Power" is given again without variation; but it is surprising to find that no mention is made of the determination of the agglutinating value of coal—even the brief reference given in the Interim Report (p. 21) having now been omitted. This is taken to be an unfortunate omission in view of the fact that this determination has proved of considerable value in the scientific investigation of coal, as well as in the scientific control of carbonization.

For the determination of the calorific value of coal, the oxygen bomb method is again described in detail. On careful consideration, it would appear that a very useful purpose would be served by a description of the alternate method of determination by means of the well-known sodium peroxide type of calorimeter. This has several factors in its favour. The apparatus is considerably cheaper, initially as well as in use; it is less cumbersome; and the determination is much more simply and rapidly carried out. Further, the "melt" obtained after the determination furnishes the material for a simpler, more rapid, cheaper, and more reliable determination of the sulphur content of the coal used than does the Eschka method. These are all considerations which have weight with the industrialist, as well as with the private analyst. Against these there is the question of accuracy of results. While with the oxygen bomb calorimeter "a closer agreement than 30 B.Th.U. must, generally speaking, be regarded as accidental" (p. 17), the sodium peroxide calorimeter will readily give agreement to within 50 B.Th.U., so introducing a possible error of 0·5 to 0·3 p.ct. This degree of accuracy is sufficient in the great majority of cases.

The succeeding chapter deals with the laboratory carbonization assay of coal. The Gray-King and the Lessing methods and apparatus are described and illustrated in detail, and a table is given showing comparisons between the yields obtained in the laboratory assay with those from horizontal retorts under similar conditions of low-temperature carbonization.

The last chapter deals with the method of reporting analyses, and the tabulation of results. The latter are given under the three headings: "Air-dried coal," "calculated to dry ash-free coal," and "calculated to coal as received." This is followed by Appendix I., dealing with the determination of the carbon dioxide in coal, and Appendix II., to which reference has already been made.

While it is realized that brevity has apparently been one of the considerations in the compiling of this publication, it is considered that in several cases valuable additions could have been made by furnishing brief abstracts of the literature to which reference is made, and of which the originals can only be obtained with considerable difficulty, particularly when occurring in foreign journals.

Another valuable addition to this publication, which could perhaps be incorporated in future issues, would be a section dealing with the analyses of coal ash and the determination of its melting-point. Such information would be highly appreciated by all industrial users of coal and coke as fuels.

* Department of Scientific and Industrial Research, Fuel Research. Physical and Chemical Survey of the National Coal Resources, No. 7. London: H.M. Stationery Office, Adastral House, Kingsway, W.C. 2; price 9d. net.

Gas in the Manufacture of "Bean" Cars.—The current issue (No. 157) of "A Thousand-and-One Uses for Gas" gives an illustrated account of how gas helps in the production of the "Bean" car. Messrs. Bean Cars, Ltd., are firm believers in gas for those operations on which the subsequent safety of the car depends—namely, delicate heat-treatment processes which, to be successful, have to be carried out within narrow temperature limits.

DRY GAS.

By W. B. DAVIDSON, Ph.D., F.I.C.

Having regard to the letter of Mr. C. Harris in the "JOURNAL" for February 16, and to the statement of Mr. Hardie in his recent Presidential Address to the Southern Association of Gas Engineers and Managers, it is perhaps opportune to compile a few notes on the above subject, treated from a physico-chemical point of view, for the benefit of readers.

Unfortunately for ease and freedom of sale of gas, there are as many as four factors affecting the volume of a definite quantity of gas, or (say) gas carrying a definite number of therms.

1. *Barometric Pressure.*—Gaseous volume is inversely proportional to atmospheric pressure. The standard pressure in gas testing is generally taken as 30 in. of mercury. The extreme variation in this country is from 28 to 32, or (say) *plus* or *minus* 6½ p.ct., or a total of 13 p.ct.
2. *Service Pressure.*—This is measured in inches of water column. It is a pressure additional to, or superimposed on, the barometric pressure. In inches of water the pressure of gas supplied in different districts may vary from 2 in. to 10 in. Seeing that the air at normal pressure supports a column of water 408 in. high (30 × 13·6), the utmost variation of 8 in. water column will be equivalent only to about 2 p.ct. in the volume of the gas measured.
3. *Temperature.*—As measured from and at freezing-point, all gases expand by a definite fraction for every degree of temperature rise. The increment in volume is $\frac{1}{273}$ for one degree Centigrade, and $\frac{1}{491}$ for every degree Fahrenheit. The lowest temperature of town gas supplied may be taken as about 40° Fahr., and the highest as 70° Fahr., representing a maximum variation in the volume of about 6 p.ct. It must be carefully noted that the average temperature of town gas at the consumers' meters is considerably lower than 60°, which has for a long time been accepted as the normal or standard temperature to which gas tests are referred. The mean annual atmospheric temperature near the surface of the ground is not more than 48° Fahr. throughout this country; and it is pretty certain that the true average temperature of gas at the inlet of consumers' meters, bearing in mind that the consumption is greatest when the weather is coldest, can only be at most a degree or two above this figure. It might safely be taken at 50° Fahr. (The writer's gas meter is in the hall of the house, not far from the kitchen. He has an accurate thermometer inserted in the inlet service pipe. It reads at the moment 46·8° Fahr. in a good flow.)
4. *Aqueous Vapour.*—Gas of any kind in good contact with wet material contains a percentage of aqueous vapour which when the gas is warm goes to swell the volume materially over and above the increase due to mere temperature rise. In other words, a liquid, such as water, introduced into an empty space or into a dry gas or mixture of dry gases will give off vapour until the gas contains a certain percentage volume of the vapour; such percentage depending on the nature of the liquid (chiefly its boiling-point) and its temperature. Now gases and vapours are miscible with each other in all proportions, and the pressure exerted by each gas or vapour is the same as would be exerted if the other gases in a mixture were not present. "Partial pressures" thus correspond to percentage volumes. Every pure liquid has a definite vapour tension at a given temperature; the tension rising rapidly as the temperature increases. Solutions of solids have reduced vapour tensions as compared with those of the liquid solvent. Thus, a concentrated aqueous solution of calcium chloride, an extremely soluble substance, has as low a vapour tension as water has at the temperature of melting ice. Hence, ordinary moist gas brought into intimate contact with such a solution will take up a new equilibrium with regard to its moisture content, giving up a large proportion of its aqueous vapour to the calcium chloride solution, which thus gradually weakens in the process and eventually requires to be concentrated by evaporation in order that it may maintain its drying effect on the gas.

The following is a short list of the vapour tensions of distilled water at various temperatures ranging from 25° to 70° Fahr., in inches of mercury:

Temp.	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
Inches	0·134	0·166	0·204	0·248	0·299	0·361	0·433	0·518	0·617	0·733
P.Ct. aqueous vapour	0·45	0·55	0·68	0·83	1·00	1·20	1·44	1·73	2·05	2·44

The figures for percentages of aqueous vapour, it will be observed, are obtained by dividing the vapour tension by 30 and multiplying by 100.

It will thus be seen that, if a gas is saturated with moisture at 55°, it will contain 1·44 p.ct. by volume of aqueous vapour. If this gas is dried to such an extent that its dew-point is 25°, it will contain 0·45 p.ct. of aqueous vapour, and thus be reduced 1 p.ct. in volume; the calorific value naturally increasing *pro rata*.

One obvious benefit to be derived from the drying of town gas is the elimination of troubles in the distribution mains and services caused by the deposition of moisture condensed in the process of cooling underground. One million cubic feet of gas saturated with moisture at 60° Fahr. contains 82·3 gallons of water. The same standard amount of gas saturated at 80° Fahr. will contain 165 gallons, and at 40° Fahr. 38·6 gallons. In cooling from 60° to 40°, 43·7 gallons, and from 80° to 40° 127·4 gallons of water, will drop out. No doubt, too, the formation of rust will be retarded by the drying of the gas.

In order to benefit by the process, the treatment will require to be carried out after measuring through the station meter; and it will be necessary to cover the water in the gasholder tank with a shallow layer of a suitable oil, unless the gas is treated after leaving the holder.

Unfortunately, under present conditions of testing, the gas undertaking would not be credited with the increase in calorific value resulting from drying, because the gas has to be tested with a wet meter, whereby the gas is saturated or nearly saturated with moisture.

At a meeting of the Central Executive Board of the National Gas Council on Feb. 8 last, a communication bearing on this subject from Mr. Hardie was submitted, in which he proposes to get over this difficulty by omitting the words "and saturated with water vapour" from section 1 (7) of the Act relating to gas testing, and adding a new sub-section to section 5 to read: "If the prescribed method of testing for calorific value involves the addition of any water vapour to the gas before or during measurement, then an appropriate allowance for the added vapour shall be made in calculating the result of the test." This proposal for altering the present prescribed method of testing the calorific value of gas was considered to be of the utmost importance.

It is to be hoped that when the present legislation is considered with a view to alteration on the lines proposed by Mr. Hardie, regard will also be had to the prescription for temperature and pressure. Standing as they do at 60° Fahr. and 30 in. barometer, they are unfair to the gas undertakings, which, on the following dictum of the Fuel Research Board in 1918, lose something like 3 p.ct. of their revenue through unjust measurement. The dictum is: "We propose that the consumer shall be charged for the thermal units which he actually receives, in the same way as the consumer of electricity is charged for the Board of Trade units which pass through his meter."

The obvious advantages which may be rightly claimed for the new process of drying town gas may be briefly enumerated as follows:

1. Elimination of stoppages of services due to the deposition of condensed water.
2. Reduction or inhibition of rusting effect on interior surfaces of mains and services, and consequent increase in life of same. Reduction in cost of main-laying.
3. Syphon pumping rendered unnecessary.
4. Naphthalene troubles more easily overcome.
5. Life and working of dry meters improved.
6. More efficient benzole extraction by oil washing is made possible.
7. Increase in calorific value of the gas supplied through dry meter. This increase will probably average about 1 p.ct. Coupled with this is a slight increase in flame temperature, due to the fact that aqueous vapour is an inert having a much higher specific heat than nitrogen.

The apparent objections are:

1. Additional cost and complication of plant.
2. Increase in quality of gas is not enjoyed by the consumer using a wet meter.
3. Unless the Regulation Act of 1920 is altered to allow the gas to be tested for calorific value in the condition the consumer gets it, the gas undertaking supplying dry gas will lose about 1 p.ct. of its revenue from gas sales, where dry meters are used. This last is, of course, a serious matter. One can hardly imagine, however, that the Gas Referees will refuse to comply with the reasonable request of the gas industry as outlined in the proposal recently put forward by Mr. Hardie.

As regards the process of drying, one finds it difficult to devise a simpler or better method than that of washing with concentrated $CaCl_2$ solution (Patent No. 248,841, C. Cooper, D. M. Henshaw, and W. C. Holmes & Co., March 11, 1926—see "JOURNAL," Vol. 174, p. 164). The last-named have recently installed plant for this process at Taunton, Bristol, Portsmouth, Weston-super-Mare, Bournemouth, and Long Eaton. Various additional patents relating to the process have been obtained by the firm; and it is expected that Mr. Harris, of Taunton, will soon be in a position to give an account of his experiences of the actual working.

INAUGURATION OF WOODALL-DUCKHAM VERTICALS AT WISBECH.

On Tuesday, April 12, the opening ceremony of the new carbonizing plant at Wisbech took place. The installation consists of Woodall-Duckham continuous vertical retorts with a gas-making capacity of 470,000 c.ft. per day.

In the morning, the plant was informally inspected by a number of gas engineers, who were subsequently entertained at lunch by Mr. John Green, A.M.I.Mech.E., the Engineer and Manager. In a short speech at the luncheon, Mr. Green gave information regarding the results and operation of his new plant. He expressed satisfaction with the ease with which the plant was started-up, and with the excellent results consistently obtained since it was put into operation.

In the afternoon, the plant was formally inaugurated by Mr. Frank Oldham, J.P., Chairman of the Wisbech Lighting Company, supported by his co-Directors and Mr. John Green. The Chairman expressed his appreciation of the expeditious way in which the contractors had carried out the work, in spite of the difficulty in obtaining materials during and following the coal dispute.

Mr. G. J. Jackson, Managing Director of the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., replied.

On the occasion of the ceremony, the works were thrown open to the public, and a number of visitors had the opportunity of inspecting the new plant, after which they were entertained by the Gas Company to light refreshments.

We take the following extracts from a specially-prepared illustrated brochure.

Historical.

In 1832, as the result of correspondence which had taken place in the previous year between the Corporation of Wisbech and Mr. Malam, of Holmpton, Yorkshire (an engineer of eminence, who had lighted Kingston-upon-Hull and other populous places), a contract for the supply of gas to Wisbech was entered into with Mr. Malam.

The foundation stone of the gas-works was laid in 1832 on a site on the Leverington Road.

In 1857 Mr. Malam intimated that it was his intention to construct new gas-works; and a year later (in view of the expiration of the contract in the following year) a meeting was held at the Town Hall, at which it was decided that, instead of renewing the arrangement, a Gas Company should be formed, and application made to Parliament for the necessary powers. The Corporation intimated its intention to give every support to the project. The prospectus of the new Gas Company was issued in November, 1858, under the title of the Wisbech Gas Light and Coke Company. The Company acquired a site in Eastfield, and made other arrangements for commencing operations, when in March, 1859, before the House of Lords Committee, it was arranged that the new Company should purchase Mr. Malam's works at a valuation. In September of that year the purchase of the works on the Leverington Road was completed. The old works at Leverington Road were utilized for a time; but ultimately new works and plant were erected in Eastfield, and the old premises were sold.

Into the more recent history of the Company it is unnecessary to enter, further than to say it proved an exceedingly remunerative undertaking for its promoters, under the guidance of its Chairman, Mr. George Dawbarn, and its first Manager, Mr. William Horsley.

In 1879 application was made to Parliament for additional powers. The title of the Company was then changed to that of the Wisbech Lighting Company. Mr. R. J. Sharman was Manager from 1879 to 1903; Mr. J. G. Hawkins from 1903 to 1919; and in 1919 Mr. J. Green, the present Manager, succeeded Mr. Hawkins.

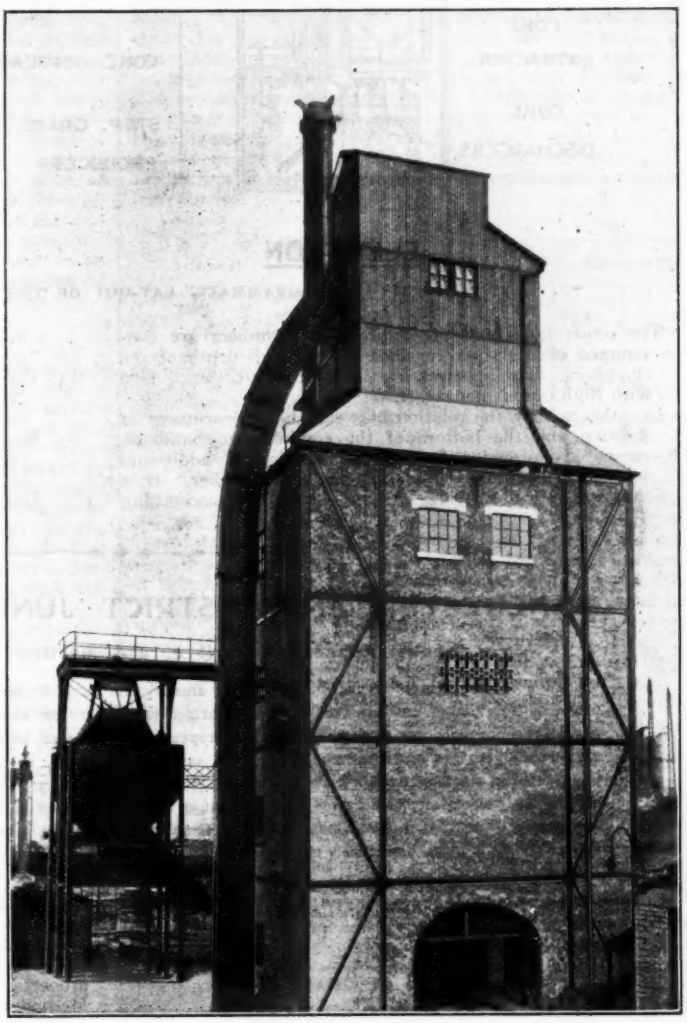
During the time Mr. Green has been with the Company he has re-modelled the whole of the works plant, including extension to the purifying plant and the installation of a Tully plant and a sulphate of ammonia plant. In 1925 the carbonizing plant had a total maximum capacity of 400,000 c.ft. per day, and consisted of a horizontal retort house (comprising seven beds of seven stop-end horizontal retorts with regenerative producers), a Tully plant, and an "Adaptable" intermittent vertical retort plant.

In 1926 it was decided to extend the carbonizing plant; and after making a study of the various types, it was arranged to instal a bench of Woodall-Duckham continuous verticals capable of producing 470,000 c.ft. per day.

Woodall-Duckham Continuous Vertical Retort Plant.

The installation consists of one bench containing six retorts, heated by means of two producers placed at one end of the bench on the retort house floor level. Coal is brought in railway wagons and discharged by hand into a small receiving hopper placed at yard level. From this hopper the coal is fed by means of a jigging feeder into a two-roll coal breaker. The feeder is fitted with a screen through which the small coal bypasses the breaker. The broken coal, mixed with small coal, is fed into a bucket elevator, and is delivered therefrom into overhead storage hoppers of 48 hours' capacity situated above the retort bench. Two specially designed steam-driven pumps are provided for supplying the circulating liquor to the mains. These pumps also supply the power to drive the coke extractors.

The surplus coke may be either run out into the yard in barrows, or taken in side-discharging skips, by means of the lift, to the level of the outside coke hoppers. At this level a timber platform fitted with light steel rails is installed, along which the skips run, and discharge their coke on to fixed bar screens arranged over a series of outside coke hoppers with a total capacity of 20 tons of breeze and screened coke.



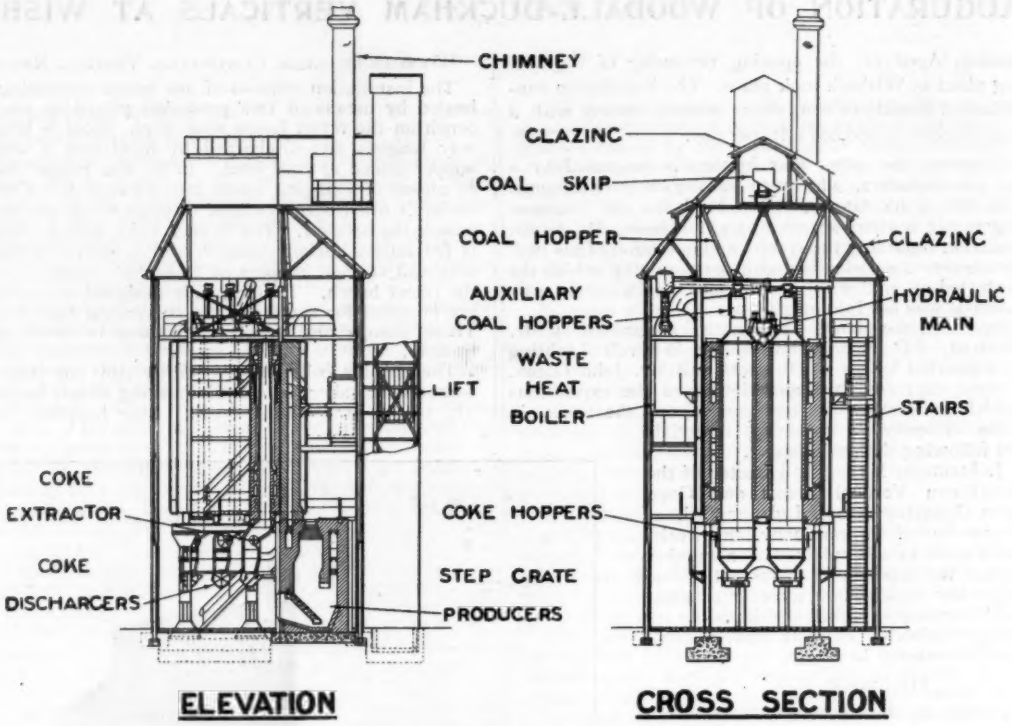
THE NEW VERTICAL RETORT HOUSE.

A waste-heat boiler has been installed for raising steam at 100 lbs. per sq. in. pressure. It is of the vertical firetube type, and is arranged to work under natural draught.

Outstanding Features.

The new plant has the following outstanding features:

1. Each retort is absolutely separate from the next; a straight joint being built between the retorts, so that each retort can be heated-up or cooled-down without in any way affecting the others. Each retort is provided with its own producer gas and secondary air inlets and waste gas flue damper. By thus arranging that each retort is a separate unit, maximum flexibility in output is obtained.



DIAGRAMMATIC LAY-OUT OF THE NEW PLANT.

2. The retort faces and the combustion chambers are constructed of high-quality silica for the full depth of the chambers. This ensures low maintenance costs coupled with high output per retort.
3. In order to vary the relation between the temperatures at the top and the bottom of the combustion chambers, means are provided for the introduction of additional secondary air at a second point in the chamber. It is thus possible to vary the zoning of the heats according to the type of coal carbonized and the calorific value of the gas to be made.
4. The producers are of special step-grate design, to reduce clinkering to the minimum, with consequent reduction in labour cost.
5. Special attention has been paid to the insulation of both the side walls and the top of the bench, with the double object of improving the working conditions and of saving fuel.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Annual Dinner on April 2, and Meeting at Widnes on April 9.

In a lecture which preceded the annual dinner, Mr. A. McCulloch considered the mechanism whereby coke is produced from coal on carbonization, and summarized the present position of knowledge in regard to the subject. Recent investigations were reviewed. The coking propensities of a coal, he stated, may be modified in various ways. By very rapid heating, coals commonly regarded as non-coking may be made to produce strong coherent coke. The paper at the meeting on April 9 was by Mr. Thomas Caldwell, of Widnes, who, in discussing the cost and efficiency of gas and electricity, suggested that it would be a good thing if the unit on which the sale of gas was based approximated to the unit of electricity. In comparison with the latter, the therm is too large, and does not help the public to realize how much more energy with gas they can purchase than with electricity for the same cost.

The Annual Dinner of the Association, which was held in Manchester on Saturday, April 2, was preceded by a lecture illustrated by lantern slides.

THE COKING OF COAL.

By A. McCULLOCH, A.M.S.T., A.I.C.

Your President, in inviting me to address you, suggested that I should speak on the much discussed and very debatable subject of low-temperature carbonization. It appeared to me, however, that our time together would be more profitably spent in considering the mechanism whereby coke is produced from coal on carbonization, in briefly reviewing some of the very numerous contributions which have been made to our knowledge of coking, and in summarizing, as far as possible, the present position in regard to this matter.

The term "coking" as commonly applied to coal defines the property which certain coals possess of forming a more or less coherent solid residue when carbonized alone. Accordingly, coals are differentiated as, for example, strongly coking, feebly coking, or non-coking, dependent upon the relative coherency and strength of the solid residue produced. It is, however, essential to recognize at the outset that "coking" is a purely relative term; the interpretation placed upon "coking" being dependent upon the manner in which the coal is carbonized. In general, a coal is spoken of as a coking coal if it yields a marketable coke upon carbonization under the conditions appertaining in an established process. On the other hand, coals which would be regarded as non-coking under such conditions may under other conditions be made to produce coke which is not simply a coherent mass, but moderately strong.

The simplest of all tests employed to determine the coking properties of a coal is that known as the Standard American Method for the determination of volatile matter, in which the conditions under which the coal is to be heated are rigidly prescribed. One gramme of coal is rapidly heated in a platinum crucible of specified size for a period of seven minutes; the resulting coke button being examined, its coherency noted, and its strength roughly determined, while the swelling of the coke is generally stated in terms of the original volume of the coal used. The conditions under which the coal is heated are widely different, however, from those obtaining in normal carbonization practice; and the test must be supplemented by a very wide experience, if the suitability of a coal for use in a particular carbonization process is to be fairly accurately gauged. Supplementary tests have therefore been devised, the commonest one being, perhaps, that in which the coal is successively heated with increasing proportions of sand or carbon of a predetermined fineness of division. The minimum ratio of carbon to coal in a mixture which is just non-coherent on carbonization[1], or in a mixture yielding a coke which will just support a standard weight, is then expressed as the "coking index" of that coal.

The property of coking has been commonly ascribed to the presence in coals of bodies of a resinous nature; and it is natural that many attempts should have been made to separate and

identify bodies of this type largely by means of resin solvents, such as ethyl alcohol, benzene, acetone, and chloroform. Frequent reference will be found in the literature of the subject to bodies variously described as "resins," "resinous substances," and "resinic constituents" as occurring in coal. "Amorphous vitreous masses" possessing the colour and appearance of naturally occurring resins have been observed on examining sections of coal under the microscope. The terms "resinic constituents" or "resinous bodies," as applied to coal, appear, however, to have become very closely associated with those bodies possessing chiefly the characteristic of softening or melting under the influence of heat. True resin solvents such as those previously enumerated, under normal conditions of extraction, yield only comparatively small amounts of extracts; and the extracted material does not appear to possess solely the property of coking. Bone[3], for example, extracted various coking coals with solvents of this type, and found that, as far as could be judged, the coking properties of the coals after extraction were not impaired. The coking property of a coal cannot, therefore, be ascribed simply to the presence in coal of little-altered naturally-occurring resins.

It is now well known that prolonged oxidation of the coal substance at normal temperatures adversely affects coking properties, and that at higher temperatures this effect is enhanced. Similarly oxidation may seriously influence the action of solvents; and it is important that precautions should be taken to carry out extractions in an inert atmosphere. Further, the temperature at which extraction proceeds should be well below that at which marked decomposition of the coal takes place; and the pressure should be correspondingly normal. Some of the conclusions arrived at, in which solvents have been used at high temperature, are subject to criticism from this point of view. Fischer[3] extracted coal with benzene at temperatures up to 285° C., being of the opinion that decomposition of the coal did not result, since extraction was not marked by the evolution of sulphur compounds. Accordingly, he concludes that "in all coals the constituents which cause swelling and coking can be removed by extraction with benzene at high temperatures."

Pyridine Extraction.

In 1899 Bedson[4] discovered that pyridine possesses a high extractive power for certain coals, and found that the residue remaining after extraction did not coke, whereas the extract freed from pyridine by treatment with hydrochloric acid produced on carbonization a light and intumescent coke. Later Clark and Wheeler[5] further separated the pyridine extract by means of chloroform into a residue possessing only slight coking properties and an extract in which practically the whole of the coking properties appeared to be concentrated. In the original paper, these authors regard this treatment as effecting a separation of the partially-changed resinous substances originally present in the coal plants and the cellulose degradation products. While the several fractions exhibited characteristics which might lead to such inferences, the terminology cellulosic and resinic was unfortunate, and has now been discarded for the terms α, β, and γ constituents respectively.

The α constituents are insoluble in pyridine, the β constituents soluble in pyridine but insoluble in chloroform, and the γ constituents soluble in pyridine and chloroform. Barash (*loc. cit.*), examining these several constituents from various coals, shows that the α constituents obtained were practically non-coking, the β constituents possessed only slight coking properties, while the γ constituents did not form a true coke, but a thin brittle skin inside the tube in which carbonization was carried out. There are, however, reasons for believing that the action of pyridine and substances such, for example, as aniline is not that of a pure solvent; it being suggested that the action upon coal is to resolve the coal into bodies of a simpler type.

These are in themselves truly soluble in pyridine or either colloidally dispersed[4] in the pyridine or enter into chemical combination with it. The action of the pyridine has therefore been spoken of, for want of a more complete knowledge, as that of a depolymerizing agent. Bone (*loc. cit.*), contrary to Clark and Wheeler's original conclusions, expresses the opinion that the bodies in coal which possess coking properties are not resinic in origin, but "appear to consist of a series of 'humic' transformation products of cellulose of varying complexity. The simpler members of this series are soluble both in chloroform and in alcoholic alkali, and they are also easily fusible. Further up the series, these substances become insoluble, even colloidally in alkali, though they are still soluble in chloroform; also their temperature of fusion rises to approach nearly that of their decomposition."

Whatever the intrinsic nature of the coking bodies which can be separated from coal by means of solvents, whether resinic or cellulosic, it must be recognized that such bodies are not presumably present in coal as such, and certainly that their physical mode of occurrence is very different on separation to that if present in a natural state in the coal. This latter is of immediate importance in determining the nature of the coke produced when the coal is carbonized. Experiments carried out by Barash (*loc. cit.*) are of interest in this connection. Samples of a strongly coking coal were treated for varying periods with pyridine, and other samples of the same coal with chloroform. The pyridine and chloroform were removed by simple evaporation and washing; separation of the several fractions not being made. The coking properties of the resulting materials were assessed by a determination of the "coking index" or agglutinating value. The treatment resulted in a marked determination of the coking properties of the coal.

Submitting coking coals to the action of bodies such as pyridine and chloroform has resulted, then, in obtaining extractable matter which has marked coking properties, and other bodies practically devoid of coking properties. Accordingly, the view is commonly held that, when a coking coal is heated, the fusion of the γ constituents results, rendering the whole mass more or less plastic, acting in this manner as a cementing or agglutinating agent. The α and β constituents, on the other hand, are considered to be relatively inert in this sense, and, indeed, are sometimes spoken of as "inert constituents." As has been pointed out, we are by no means certain of the nature and distribution of these so-called constituents; and, further, identification and correlation of the α, β, and γ constituents from various coals does not appear so far to have been attempted.

Foxwell[7], in the course of a reply to Illingworth, says: "There appears to have arisen in these later days a 'heresy' which affirms that the gamma compounds *per se* do not constitute the coking element of coal. I must count myself a heretic. Careful reading of the arguments put forward will show that the gist of the matter lies in the distribution of the gamma compounds in the coal, in their thermal stability, and in their mode of extrusion from the individual pieces of coal." The contention of Illingworth[8] that a minimum of 5·5 p.ct. of γ constituents is required for a coal to yield a good quality of coke, is not tenable in every case. It will suffice to quote examples given by Foxwell[9] to emphasize this point; a non-coking coal being shown to contain considerable amounts of γ constituents.

Table I.

Description of Coal.	Coking Index.	Composition.			Nature of Coke.	
		P.Ct. α Constituents.	P.Ct. β Constituents.	P.Ct. γ Constituents.	Lab. Test.	Works Results.
North Yorkshire Coal. N.Y. 5	11	68·8	14·7	16·5	Fair	Not suitable
South Wales Coal. S.W. 1	10	87·8	7·2	5·0	Good	Good
South Wales Coal. S.W. 4	6½	99·5	0·4	0·1	Fair	Not suitable

Little attention has been paid to the influence which such non-coking bodies as may occur in coal may have upon the coke-forming properties of the coal. If these bodies may be regarded as entities during the process of actual coke forming, it becomes at once obvious that their chemical and physical nature will influence the amount of cementing material required to bring about complete cohesion; such factors as porosity[10] and phenomena associated with the wetting of solid surfaces requiring consideration[11]. Similar remarks apply in considering the adhesion of individual particles of coal, as in the case of coke formation on an industrial scale, although here other factors naturally come into play.

Some Recent Investigations.

Many investigators have shown that the coking properties of coal are profoundly modified by the action of heat at low temperatures—in some cases well below the recognized temperature of decomposition. Illingworth (*loc. cit.*) postulates a theory of coking based upon the relative thermal stability of the β and γ constituents; but in view of the foregoing, the desirability of considering coal as a whole, in studying coking, will be conceded. Attention may therefore be directed to a few of the most striking of the many investigations which have been carried out recently in which the coking of coal in its entirety has been studied. These have proceeded in many cases along novel lines; but it will, I think, suffice to cite the results obtained by three workers.

Foxwell[12] adopted a method whereby coking phenomena were studied by measuring the pressure required to force a constant volume of gas at normal temperature and pressure through a plug of coal of standard cross-sectional area and length; the coal being gradually raised in temperature under controlled conditions. By plotting the requisite pressures against the temperatures at which the coal was heated, graphs termed "plastic curves" were obtained. By interpretation of such graphs, the influence of various factors—such as rate of heating, size of coal particle, and preheating of coal—upon the coking properties of the coal were studied.

The commencement and range of plasticity were in this way determined for a variety of coals; it being found in general that the curves obtained for the same coal under the same conditions of experiment were identical. At temperatures between 350° and 400° C. the resistance to gas flow rapidly increased, marking the commencement of plasticity in the coal. The resistance finally reached a maximum in the neighbourhood of which it either remained for a considerable range of temperature or fell rapidly with increasing temperatures. All the coking coals examined exhibited plasticity over a range of 370° to

500° C.; the latter temperature only being exceeded when the coal was rapidly heated. The rate at which the temperature of the coal was raised, particularly up to 350° C., varied the nature of the curve very considerably; for while the temperature of initial plasticity was only slightly affected, the maximum resistance and the extent of the curve were found to be greater with an increased rate of heating. Similarly, fineness of division and compression of the coal were found to have a very marked influence; these raising the maximum resistance encountered and the range of temperature over which plasticity persisted. On the other hand, preheating of the coal and weathering modified initial softening and plastic range in the reverse direction.

One interesting observation made by Foxwell was that non-coking coals may not function simply as inert materials, but may actually possess what may be termed negative coking properties. Coals, then, to produce coherent coke on carbonization, must not simply possess the characteristic of softening under the influence of heat, but the state of plasticity produced must persist over a definite interval of time, and exhibit certain other features. While Foxwell has studied, along with other workers, factors influencing the commencement of softening and the range over which the coal is plastic, Audibert[13] has carried these studies farther by employing experimental methods, which, while differing from those of Foxwell, show certain similarities.

The coal to be examined, after preparation of the sample, was slightly moistened with water, moulded into the form of a pellet, and compressed to an exactly measured density. It was then placed in a suitable vertical furnace, the temperature of which could be accurately controlled. Precautions were taken to prevent oxidation of the coal occurring. Physical changes in the coal were noted by the movement of a counterpoised glass rod just resting on the coal; the pellet being almost exactly equal in diameter to that of the furnace. Softening of the coal was shown by a slight downward movement of the glass rod, owing to the coal becoming more or less fluid, and completely filling the annular space between the inside of the furnace and the original pellet. Increasing the temperature above a certain point caused an upward movement of the rod, marking the commencement of swelling or intumescence in the coal. In twelve coals examined, softening points ranged from 325° to 450° C.; while intumescence began at temperatures of from 375° to 500° C. It will be noted that these figures are in fair agreement with those given by Foxwell.

Once a coal softens, whatever heat treatment may be adopted, solidification will ensue, even if the temperature remains in the close neighbourhood of the softening point and never reaches that of intumescence. At temperatures well below the softening point certain coals undergo profound changes, whereby on raising the temperature softening no longer takes place. Other coals, however, after prolonged heating at low temperatures, do not appear to be rendered infusible; changes at such temperatures not being appreciable by any loss in weight. Intumescence always commences above the softening point, and above the initial decomposition point as shown by the marked evolution of volatile matter. Before intumescence can take place, the individual particles of coal in the heated mass must lose their identity; the spaces between the particles being so filled with plastic material, or obstructed, that gas generated by the decomposition of the mass can no longer find an exit. In this sense, prior to intumescence the coal must become homogeneous.

The viscosity of the mass will obviously be important, since if the time during which the mass is plastic does not allow sufficient flowing of the material, with the obstruction of the means of exit, no gas will be entrapped, and intumescence will not take place. Rate of heating directly affects the viscosity of the material and the range of plasticity. With rapid heating, the mass appears to be less viscous, the spaces are readily closed, and decomposition of the material causes a "blowing-out" of the coal, with the formation of a sponge-structure prior to rigidity finally setting in. When the rate of heating is slow, the viscosity of the mass does not allow of rapid flow; and decomposition of the mass, as it were, outstepping softening, rigidity is arrived at, and the gas finds easy access between the particles. The possibility of producing by rapid heat penetration hard coherent coke from coals normally regarded as non-coking coals becomes therefore apparent.

Finally, brief reference may be made to changes which take place when the state of plasticity is over, and the mass becomes completely rigid. Recent years have seen a constantly increasing amount of work upon the influence which coke structure plays in determining combustibility and reactivity—properties which largely define the uses to which a particular coke may be put. The year 1922 saw the publication of three important contributions to the subject of the structure of coke—namely, those of Greenwood and Cobb[14], Sutcliffe and Evans[15], and Beilby[16]. Beilby, after discussing the manner in which coke is produced, suggested that decomposition at increasing temperatures caused the development of more minute cells within the already-formed walls of the coke.

It has remained, however, for Sinnatt[17] to actually demonstrate the development of such a minute structure. By allowing particles of coal of a pre-determined size to fall through a zone of high temperature in a vertical furnace under the correct experimental conditions, it was found that the particles emerged as hollow spheres or "cenospheres." Rapid heating of the particle was ensured by this procedure. The particle of coal having softened, the generation of gas within the particle caused it to assume the spheroidal shape prior to solidifying. The "cenospheres" are seen to possess in general a structure which can, perhaps, be aptly described as "lattice structure," portions of the cenosphere being more or less transparent and conveniently described as windows, while the opaque portion can be termed "ribs" or "window frames." Close examination of these bodies reveals the presence of minute specks in the envelope, occurring on window and rib alike, the nature of which it has proved extremely difficult to determine. Those bodies may well be compared with the later developed structure postulated by Beilby (*loc. cit.*); but at present it is impossible to state whether they consist of openings, complete bubbles, or simply cavities.

When cell formation is complete, and the coke has attained rigidity, further decomposition results in increased specific gravity of the material, accompanied by marked shrinkage. With prolonged exposure to high temperatures, the coke becomes more and more vitreous; gradual graphitization of the carbonaceous matter occurring.

Knowledge of Coking Phenomena Summarized.

Our knowledge of coking phenomena may therefore be summarized as follows:

While coking and non-coking coals *per se* may be distinguished, the property of coking exhibited by certain coals is very largely dependent upon the conditions under which the coal is heated, more particularly the rate and duration of heating. Coking must always be preceded by softening of the coal; the temperature at which softening takes place varying considerably with different coals. The coherence and strength of the coke is determined by the properties of the plastic mass so obtained; the viscosity of the softened material being especially important. If the viscosity of the material is such that the spaces between the particles of coal are closed or obstructed, gases resulting from the decomposition of the material with increasing temperatures cause intumescence or swelling, and with further decomposition the whole mass is fused together. The particles of coal lose their identity, and the mass in this sense can be termed homogeneous. The phenomena accompanying the establishing of such a condition is not completely understood as far as the single particles are concerned; it being obvious that extrusion of plastic matter from individual particles may take place, or the entire particle may soften and become one with adjacent particles.

Factors involved in the extrusion of plastic material, in surface tension, and in the wetting of solid surfaces have received consideration from various investigators. Entrapping of the gas thus gives rise to the common cell structure characteristic of coke, the gas probably finding an exit when rigidity of the mass has set in through perforation of individual bubbles at their points of contact. On the other hand, it has been stated that non-coking coals produce a coke possessing a cellular structure presumably within each individual particle. Once the coal has softened, whatever heat treatment is adopted solidification will take place; but the period during which plasticity persists is determined by the rate of heating of the coal. Certain coals can be rendered infusible by preheating at temperatures below the recognized decomposition point for varying periods, in an inert atmosphere, so that if the temperature be subsequently raised above the softening point, individual particles still retain their identity. It has, however, been found impossible with other coals to destroy the property of softening by long periods of preheating, although the degree of intumescence may be modified by such treatment. By very rapid heating, coals commonly regarded as non-coking may be made to produce strong coherent coke.

The coking propensities of a coal may be modified in other ways—namely, by oxidation of the coal, submitting the coal to the action of chemical agents, particularly those of an oxidizing nature, and the intimate admixture of the coal with material possessing little or no coking power. By treatment with substances such as pyridine and chloroform, bodies possessing no coking properties and others in which the coking properties of the coal appear to be concentrated may be differentiated. Opinions as to the chemical nature of the latter vary—some investigators terming them "cellulosic," and others "resinic" in character (the term "resinic," however, having an extremely loose interpretation). This action does not appear to be a purely solvent one, involving apparently a breakdown of the original coal substance, with the production of bodies which are soluble, colloidally dispersed, or chemically combined with the extracting material. It may be that such bodies are produced in the coal by the action of heat, and initially serve alone, or their decomposition products serve, as the cementing agent or extruded material necessary for coke formation. It is, however, impossible to postulate a minimum quantity present in a coal in order for such a coal to form a coherent coke on carbonization under industrial conditions; their thermal stability, manner of distribution, and properties all being important.

Subsequent to the formation of what may be termed the ele-

mentary structure, further decomposition appears to result in the production of a minute cellular structure within the already-formed walls of coke. Increasing temperatures result in increased specific gravity of the material and marked shrinkage of the mass—the coke becoming more and more graphitic and vitreous in nature.

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A discussion ensued, which was contributed to by Messrs. S. Carter (Liverpool), W. Buckley (Manchester), C. Kay (Bury), and J. Bridge (Elland).

On the proposition of Mr. H. P. Lupton (Liverpool), seconded by Mr. H. C. Applebee (Manchester), a hearty vote of thanks was passed to the lecturer.

MEETING ON APRIL 9.

The Association visited Widnes on April 9. They assembled at the Town Hall, where they were received by the Gas Engineer, Mr. C. E. DICKINSON. From the Town Hall they were conveyed by special buses to the gas-works.

WIDNES GAS UNDERTAKING.

The Widnes Gas-Works were founded by a Private Company in 1860, and in 1867 were acquired by the late Local Board. At the time of the transfer, the annual make of gas was 13 million c.ft. The quantity of gas made last year was 539 millions. The total number of consumers is now 8625.

The retort house is a steel-framed building, 214 ft. long by 62 ft. wide by 47 ft. 6 in. high. There are three benches of horizontal retorts. The furnaces are of Drakes patent tube regenerator pattern, except for three which are on the Klönne principle. On the discharging side of the house, special platforms are arranged to run on rails laid on the floor, for inspection and scurfing purposes, and on these rails also run the shoots for supplying the furnaces with hot coke direct from the retorts.

Coal wagons run through the coal store, and are tipped by an electrically-driven end tipper into a receiving hopper, from which the coal is fed either to the breaker or through a by-pass shoot into the elevator boot. The breaker, elevator, and a push-plate conveyor running over the storage hoppers are capable of dealing with 30 to 35 tons of coal per hour. The hoppers hold sufficient coal to give 48 hours' supply to the installation when working at full capacity.

The electrical power generating plant is in duplicate. The dynamos are each capable of giving a continuous output of 50 KW., 225 volts, direct current, and are driven, through flexible couplings, by 95 B.H.P. gas engines running at 210 R.P.M.

The coke conveying plant is built on the high-speed, monorail telpher system. The travelling speed is 500 ft. per minute, and the gross lifting capacity 45 cwt. at a speed of 50 ft. per minute. A 12 B.H.P. totally enclosed motor is used. At each end of the retort house a cast-iron tank for quenching the coke is provided. These tanks are 14 ft. long by 8 ft. wide by 5 ft. deep. At certain positions on the outside track, inclined screens are fixed directly under the path of the coke skips, to deliver coke direct into railway wagons.

The works are well equipped with siding accommodation; there being two separate lines on the east side of the retort house, for coal, and a third one for coke on the west side. Each line of siding is provided with a wagon weighbridge.

Other works plant consists of exhausters in duplicate, two sets of atmospheric condensers, Livesey washers, two tower scrubbers, a Holmes rotary naphthalene washer, purifiers, pan ash washer, blue water gas plant of a capacity of 500,000 c.ft. per diem, and sulphate of ammonia plant of a capacity of 3 tons per diem.

The total capital expended on the gas-works, including the original purchase money, up to March 25, 1926, was £219,456, of which £167,688 has been paid off through sinking fund, &c., leaving the loan capital outstanding at £51,768.

The Mayor of the Borough, Councillor J. Millar, J.P., and Miss Millar, the Mayoress, met the party at the gas-works, and accompanied them to the showrooms. Here the Mayor welcomed the visitors.

After inspecting the showrooms, the visitors proceeded to the Belle Vale Pumping Station and the Stockwell Pumping Station.

Tea was served in the Recreation Club Pavilion of Messrs. J. H. Dennis & Co., where the party were joined by the Chairman of the Widnes Gas Committee.

Mr. C. H. BAMBER, B.Sc. (Bolton), moved a vote of thanks to the Mayor and the Gas Committee. He thought that Widnes was to be congratulated upon the results attained.

Mr. J. R. COOK (Southport) said that they had seen the latest practice in horizontal retorts carbonizing cheap slacks. The Widnes Works were fortunate in having such a small capital charge. The Gas Committee gave the Engineer every encouragement; and the principle of not requiring the gas undertaking to contribute towards the relief of rates must be a great help to the undertaking.

Councillor HARDMAN (Chairman of the Gas Committee), acknowledging the vote, paid a high tribute to their late Engineer, Mr. Isaac Carr, who, he said, had placed them in the position they held that day in the gas industry. The price of gas at Widnes was not raised during the recent coal strike—a fact which was most gratifying to all.

Mr. DICKINSON also acknowledged the vote of thanks.

COST AND EFFICIENCY OF GAS AND ELECTRICITY.

By THOMAS CALDWELL, M.Eng., of Widnes.

[Extract.]

In the process of the conversion of energy, the thermal balance-sheet must always be closely related to the financial balance-sheet.

Thermal Efficiency of Carbonizing Gas Coal in Horizontal Retorts.

Heat Contained In:	P.Ct. of Total Heat in Coal Carbonized.
Gas sold	23·2
Gas loss	2·0
Coke sold	49·3
Tar	6·8
	81·3
Heat lost in manufacture	18·7
	100·0

The above figures, which show an efficiency of over 80 p.ct., are the results of careful and long-continued trials. They were published in the report of the Fuel Research Board for the year 1925.

The average thermal efficiency of electricity generating stations—coal to electricity—given in the same report was only about 13 p.ct. The maximum efficiency of any one station was 20·3 p.ct.; this being approximately the figure obtainable in super power stations.

THE METHOD OF CHARGE.

Unfortunately the unit upon which the price of gas is based is different from the electrical unit. The actual difference in the price of equal units is not generally realized by consumers until evidenced in the accounts; the electricity account invariably being very much in excess of the gas account for the same energy. This difficulty of comparison indicates the desirability of charging for gas and electricity upon the same unit.

As a unit of heat, a therm of gas is 29·3 times as large as a B.O.T. unit of electricity. Thus, to provide the same number of heat units at the same cost, the kilowatt-hour would have to be approximately one-thirtieth the cost per therm of gas.

The price charged to domestic consumers in Widnes for gas is 6·32d. per therm, and for electricity 4d. per unit for lighting, and 2d. for cooking. For the same amount of energy, therefore, electricity is $\frac{4d.}{6·32d.} \times 29·23 = 18·5$ times as dear as gas for lighting, and 9·25 times as dear for cooking purposes.

ENERGY FOR POWER.

In the utilization of electrical energy for power purposes, the losses involved are mostly complete at the generating station. Transmission losses are low, and the electrical motors in which the energy is converted into useful work have efficiencies in the region of 90 p.ct.

The suitability of electricity for power has been definitely established, and cannot be disputed. The flexibility of its conductors, the ease with which it can be collected, and the efficiency and compactness of the machines are outstanding characteristics which make it admirably adaptable to all types of mechanical power plant.

The only consideration is whether it is cheaper for the consumer to generate electrical energy by means of a prime mover, or take it from the local supply mains. With regard to this, it is significant that by far the largest consumers of gas in Widnes utilize it to generate their own electricity. The plant comprises two sets of 180 H.P. horizontal twin-cylinder "National" gas engines driving alternating current generators by flexible ropes. The quantity of gas consumed by them from Jan. 1 to Dec. 31, 1926, for electricity generation only was 65,890,000 c.ft.; the total electricity generated being 1,939,615 units. The gas consumption was 34 c.ft. per kilowatt-hour;

the average calorific value of the gas being about 475 B.Th.U. (gross).

Average percentage thermal efficiency, gas to electricity = $\frac{1{\cdot}34 \times 33000 \times 60}{34 \times 778 \times 475} \times 100 = 21{\cdot}1$ p.ct.

Net price charged for the total gas consumed was £4411 4s.
Average price per 1000 c.ft., 1s. 4d.
Cost of gas per unit generated, 0·545d.
Total cost per unit generated, including gas, wages, oil, ropes, cleaning waste, and repairs and renewals, 0·8d.
Depreciation and interest on cost of buildings and plant are not included.

The conditions under which this plant works are probably better than obtain in most cases. The load factor can be maintained practically constant, and averaged 75 p.ct. for the year given.

How the efficiency of generation decreases with the load, with consequent increase of gas consumption per unit of electricity generated, may be seen from the following results obtained on a test of the electrical generating plant at the Widnes Gas-Works.

Test of 90 H.P. *Single-Cylinder Horizontal, XAE Type, "National" Gas Engine at the Widnes Gas-Works.*

Running on town gas—calorific value 487 B.Th.U. (gross). Feb. 3, 1927.

Test No.	Approx. Load.	R.P.M.	Average Electric Meter Readings.		Kilo-watts.	B.H.P.	I.H.P.
			Volts.	Amps.			
1 . .	Full load	205	223	230	51·3	76·5	95·1
2 . .	¾ ,,	206	171	229	39·15	59·6	74·6
3 . .	½ ,,	208	116	232	26·9	41·0	56·0
4 . .	¼ ,,	208	64	233	14·9	25·0	40·0
5 . .	No load	210	—	—	—	—	—

Test No.	Gas Consumed per Hour, C.Ft.	Gas Consumption per Hour, C.Ft.			Thermal Efficiency, Gas to Electricity. P.Ct.	Assumed Efficiency of Generator, P.Ct.
		Per KW.-Hour.	Per B.H.P.	Per I.H.P.		
1 . .	1490	29	19·5	16·3	24	90
2 . .	1200	30·6	20·2	16·1	22·8	88
3 . .	920	34·2	22·4	16·4	20·5	85
4 . .	660	44·3	26·4	16·5	15·8	80
5 . .	332	—	—	—	—	—

Working with gas of net calorific value 440 B.Th.U. (487 gross), the standard results obtained and guaranteed are about as follows:

Full load . . . . . 22·8 c.ft. per B.H.P. per hour.
Three-quarter load. . . 23·75 ,, ,, ,,
Half load. . . . . 25·8 ,, ,, ,,

Assuming the efficiency of an electrical generator to be 90 p.ct. at full load, the thermal efficiency of gas to electricity obtainable with the full load figure of gas consumption given above would be—

$$\frac{33000 \times 60 \times 90}{778 \times 487 \times 22{\cdot}8 \times 100} \times 100 = 20{\cdot}6 \text{ p.ct.}$$

This, multiplied by the thermal efficiency figure of 80 p.ct. for the process of carbonization, gives an efficiency of coal to electricity of 16·48 p.ct. This figure compares favourably with the average obtained in existing electricity generating stations, but it is not sufficiently high to compete with the figures obtainable in super power stations. From this point of view, the outlook for gas as a supply for power purposes is not too hopeful.

Heating and Cooking.

Some of the available heat produced by a gas fire is lost. It cannot, therefore, attain the 100 p.ct. efficiency claimed for the electric fire. A realizable 70 p.ct. efficiency, however, still enables the gas fire to give an appreciable saving in cost. Gas fires fitted with the "injector ventilating" flue outlet have the additional advantage of aiding ventilation.

The relative costs of heating a room by gas and electricity, assuming the above efficiency figures and with prices as charged in Widnes, would be as follows:

Assuming a room to require 20,000 B.Th.U. per hour.

Cost with gas . . $\frac{20{,}000}{100{,}000} \times \frac{100}{70} \times 6{\cdot}32$d. = 1·8d. per hour.

,, ,, electricity $\frac{20{,}000}{3415} \times 2$d. = 11·7d. ,, ,,

Therefore, the cost of heating the room with electricity is 6½ times the cost of heating it with gas.

With regard to cooking, exhaustive practical tests have been carried out by well-qualified persons. These tests proved that, with gas at 8d. per therm and electricity at 1d. per unit, the cost of cooking three meals per day for six persons is 2d. for gas, as compared with 6d. for electricity. At the above prices, the cost of cooking with electricity is three times that with gas.

At the Widnes prices of 6·32d. per therm for gas and 2d. per unit for electricity, the cost of cooking the above meals would be 1·58d. for gas, and 1s. for electricity—the cost with electricity being 7¼ times that with gas.

To equal gas in cost for cooking under ordinary working conditions, electricity must be supplied at a price per unit not more than 1/24th the price of gas per therm.

Lighting.

For lighting purposes electricity has to some extent displaced gas. Cleanliness, ease and flexibility of control, and adaptability to decorative schemes are the self-recommending features of electric lighting. That it is more costly than gas lighting is undisputed, but the lighting account is usually too small for the saving which would be effected by using gas to outweigh other considerations.

A visit to a modern gas showroom which displays the latest type of gasfittings will convince consumers that gas lighting is making rapid headway, and is becoming a more competitive proposition.

The following figures indicate the comparative costs of lighting by gas and electricity.

Gas Burners.

With gas of 475 to 500 B.Th.U. gross.

Inverted burner . . . . . 20 C.P. per c.ft.
Superheated burner . . . . . 30 C.P. ,, ,,

Electric Lamps.

Metal filament . . . . . 1·3 watts per C.P.
Gasfilled . . . . . 0·8 ,, ,,

Cost per 1000 C.P. Hour.

With gas and electricity at Widnes prices of 6·32d. per therm and 4d. per unit.

Inverted burner . . . . . 1½d.
Metallic filament lamp . . . . . 5·2d.
Superheated inverted burner . . . . . 1d.
Gasfilled electric lamp . . . . . 3·2d.

The above example shows that the cost of lighting by electricity is three times that by gas.

Mr. Roberts (Liverpool) moved, and Mr. Goodier (Runcorn) seconded, a vote of thanks to the author, to which Mr. Caldwell replied.

Discussion on the paper was adjourned.

CORROSION OF METALS AT JOINTS AND CREVICES.

The author gives reasons for concluding that the choice of materials which are to come in contact at a joint should be made with a view to minimizing the E.M.F. due to contact of dissimilar metals, although in some cases it may be advisable to make the metal presenting the smaller area weakly cathodic to the other. The nature of the joint itself is important; and care should be taken to avoid crannies which will be anodic towards the main surface. Perhaps the most dangerous condition is a capillary crevice existing between two dissimilar metals. Here the portion of the surface of the nobler metal near the mouth of the crevice will function as the cathodic area; while inside the crevice the base metal, and often the noble metal also, will suffer anodic attack. It is important, whenever possible, to apply some coating of efficient protective paint, varnish, or plastic composition to the joints, with special reference to places where microscopic crannies may exist. The possibility of bulging due to cranny-corrosion is another matter of which account must be taken.

At a recent meeting of the Royal Society of Arts, in John Street, Adelphi, Mr. Ulick R. Evans, M.A., who is a member of the Corrosion of Metals Research Committee of the Department of Scientific and Industrial Research, read a paper on "The Corrosion of Metals at Joints and Crevices."

He dealt first with the older electro-chemical view of corrosion, in which it was tacitly assumed that the currents were set up by the contact of two dissimilar substances, which became the two poles of a short-circuited cell. If this were the case, he said, one might expect corrosion to be most intense at joints where dissimilar metals were in contact, or in alloys consisting of an aggregate of two different phases. Actually, observation showed, speaking generally, that the junction of dissimilar metals often did constitute the seat of severe corrosion, and that on the whole heterogeneous materials were more liable to attack than homogeneous materials. But observation also showed that intense corrosion often occurred in essentially homogeneous metal which was not in contact with any other metal at all; and since the older electro-chemical view offered no explanation of these latter cases of attack,

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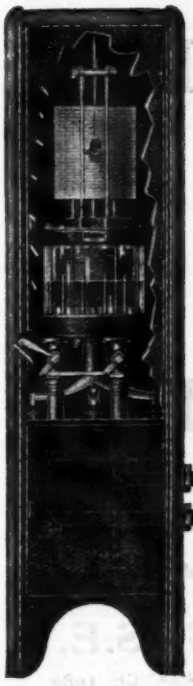

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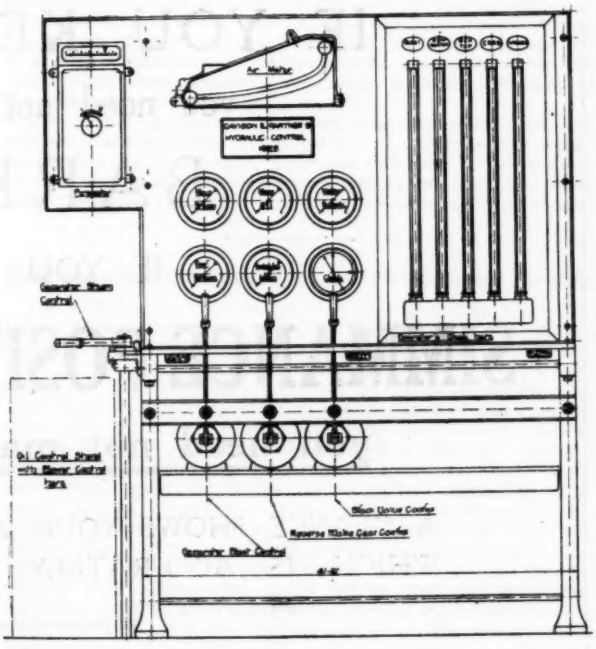

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many reasonable observers abandoned the argument that corrosion was essentially an electro-chemical phenomenon. The error of this view lay in assuming that the generation of currents in an electric cell requires two dissimilar metals. It was forgotten that electric cells are known in which the two poles consist of the same metal in different solutions. On the other hand, the newer electro-chemical view of corrosion, while not overlooking the first method of generating a current, takes account also of the second.

Particularly important are the so-called differential aeration currents set-up by variations of oxygen concentration. A current can be furnished by a cell consisting of two electrodes of steel cut from the same sheet, and immersed in salt water; oxygen being bubbled over one, but not over the other. The current will continue to flow as long as oxygen is supplied; but it should be noticed that it is provided by the corrosion of the electrode which is screened from oxygen. In all differential aeration cells, whatever the metal or liquid, it is always the "unaerated" electrode which is the "anode" or corroded pole.

Principle of Differential Aeration.

This principle of differential aeration, the author went on, helps us to understand the distribution of attack in all cases where the presence of oxygen is needed for corrosion. It supplies the key to the curious paradox that although oxygen may be essential for the corrosion of a certain metal by a certain liquid, yet the actual attack occurs at the very places most inaccessible to oxygen. With a vertical iron sheet partly immersed in salt water, for instance, corrosion occurs over the whole of the lower portion; but just below the water-line, where the oxygen has best access to the metal, is a zone which remains bright and unchanged. Corrosion may also be localized where the metallic surface is screened from oxygen by contact with an inert substance. Further, this principle explains many cases of pitting or cranny-corrosion. If a crack or pore in a piece of metal, or a crevice between two pieces of metal, be filled with liquid, the interior will become anodic to the main part of the surface; and corrosion will burrow down here, enlarging and deepening the original cavity.

Corrosion at Submerged Joints.

The two principal methods of generating corrosion currents affect the question of submerged joints in the following ways:

Contact between Dissimilar Materials.—The two pieces to be joined may themselves be dissimilar metals; or if the pieces are both composed of the same material, they may yet be united by means of a second material—*e.g.*, solder. Or, again, where the pieces are of iron or steel, the heating may give rise to another conducting substance, the magnetic oxide, which can act as a cathode towards the iron itself. Even in cases where all these occurrences are avoided, the joint may leave the metal locally in a state of stress; and since stressed material is electro-chemically different from unstressed metal, the effect is comparable to that produced by two dissimilar materials in contact.

Differential Aeration at a Joint.—There is scarcely any kind of joint which may not occasionally—either through faulty design or faulty execution—provide the type of crevice needed for anodic attack as a result of differential aeration. Often, however, the crevices formed at joints are actually less liable to produce this kind of attack than are the pores naturally present in the metal elsewhere than at the joint.

The first type of attack may itself give rise to the second. The product of corrosion set up by the junction of two dissimilar metals may accumulate at the joint, and serve to shield the surface from oxygen, thus causing anodic attack to both metals.

Localized Corrosion Most Dangerous.

It is necessary, Mr. Evans said, to regard as most dangerous those factors which tend to localize corrosion upon a limited area. The most dangerous conditions for the intensification of corrosion at the contact between dissimilar metals will exist when the anodic metal is a small mass embedded in the relatively large surface of the cathodic metal. The maximum value of the total corrosion possible is set by the rate at which diffusing oxygen is supplied to the cathodic surface. If the attack, however, is all concentrated on the small anodic part, the result may be serious. This has a practical bearing on the choice of materials for rivets.

Joints Exposed to the Atmosphere.

In connection with joints exposed to the atmosphere, crannies or crevices again introduce an element of danger. If once water gets into such places, it is likely to be retained even after the main parts of the surface have become dry through evaporation. The recesses of the crannies will then become anodic; and, if the water contain electrolytes, anodic attack may penetrate and enlarge the crannies. This danger is somewhat insidious, since ordinary inspection does not always reveal the deterioration. Fortunately atmospheric corrosion, whether localized at crannies or spread out generally, is always extremely slow if the liquid resting on the metal is pure water.

If, however, the water clinging to the metal contains an electrolyte, attack may be very rapid. It is in these circumstances that the effect of crevices becomes serious. In coal-mining districts, the water may pick-up sulphurous and sulphuric acids; near chemical works, it may absorb hydrochloric or nitric acids; at gas-works, it may take-up hydrogen sulphide. Some years ago, the author carried out in closed vessels a series of experiments upon the effect of contacts between dissimilar metals on corrosion by a moist atmosphere containing gaseous impurities. The impurities studied were hydrogen chloride, sulphur dioxide, ammonia, carbon dioxide, and hydrogen sulphide; while the principal metals employed were iron, copper, lead, and zinc. In the presence of moisture alone—even though the air periodically became super-saturated and deposited water on the metal—no serious corrosion occurred at the junctions or elsewhere. The impurities mentioned above promoted the general corrosion in many cases; and in a few instances there was specially marked attack at the contact between dissimilar metals. Thus in moist hydrogen chloride, zinc, although rapidly attacked everywhere, was rather more rapidly attacked at the contact with copper than elsewhere. There also appeared to be rather special attack of zinc at the contact with lead; the lead receiving corresponding protection along the boundary line. But in this case the effect was trivial. On the whole, the effect of dissimilar metals was only appreciable under conditions which would have caused rapid destruction of one of the metals even in the absence of the second.

Riveting.

If rivets are of a material anodic towards the plates which have to be joined together, they may quickly be eaten away. Speller suggests that, for structural steel-work, the rivets should contain a small amount of copper, so as to be slightly cathodic toward the main material. He also condemns excessive cold-working of rivets, since "it may tend to start incipient cracks, and accelerate corrosion by contact with other parts which have not been cold-worked." Newman, in discussing structural work, argues that, "as any voids in rivet work will admit air and moisture, bad riveting is sure to result in accelerating corrosion, even if it does not cause it to appear."

Soldered Joints.

Other things being equal, the danger of failure of a soldered joint by corrosion would seem to be greatest if the solder is anodic towards the metal to be joined. In this case, the attack will be concentrated on the small area of the solder itself, which may, in course of time, disintegrate. In many instances, the currents generated between solder and various metals are stronger and more persistent if the liquid employed contains chlorides. It seems worth while, therefore, said Mr. Evans, to raise the question whether it is wise to use fluxes containing chlorides, traces of which may remain when the article is put into service. Soldering solutions which give off fumes of hydrogen chloride are particularly objectionable, since they may cause iron to rust far away from the joint itself. It should also be noted that the chlorides of many metals (notably aluminium, zinc, and iron) are hygroscopic bodies, and that soldered joints in which traces of chlorides have been left may remain moist even on dry days—a circumstance favourable to continued corrosion. Moreover, the protective oxide-film which often forms naturally on metals becomes inefficient in the presence of chlorides.

The special corrosion at soldered joints on aluminium has aroused much attention. Here the use of a chloride flux would be particularly inadvisable, since the resistance of aluminium to corrosion is due largely to the formation of a protective film. Moreover, aluminium chloride is extremely hygroscopic.

Removing Colouring Matter from Low-Temperature Tar Oils.

The question of the removal of colouring matter from low-temperature tar oils was discussed by Messrs. S. P. Burke and S. Caplan in a paper which they presented to the Gas and Fuel Section of the American Chemical Society. It had been shown by them previously that the red colour of aqueous extracts and emulsions of low-temperature tar oils which makes them unsuitable for the insecticide and disinfectant trade is due to a large number of ortho-dihydric phenols. Several methods have been developed for the economical removal of these colour-producing bodies; each method depending upon some chemical property characteristic of this class of compounds. Their combination with boric acid to form relatively strong acids has been made use of in the development of a method of removal employing aqueous borax solution; but the efficacy of this treatment varies widely with the conditions. Since the disposal of the red borax extract might be attended with difficulties, and also in order to reduce the cost of treatment, a plan of separating the colouring matter in solid form from the borax extract was developed, permitting the re-use of the borax and the ready disposal of the waste solid matter. The use of lead acetate to form insoluble lead salts of the dihydric phenols is the basis of a second method of removal of the colouring matter. A third suggestion is to make use of the oxidizing power of ferric compounds and the resulting formation of insoluble, non-volatile iron salts of the oxidized colouring matter. In its preferred form, this method involves a single distillation of the oil over suitable ferric compounds for the complete removal of the colouring matter.

THE INTERNATIONAL CONFERENCE ON BITUMINOUS COAL AT PITTSBURGH.

By Dr. R. Lessing.

[The following extracts are from a paper read by Dr. R. Lessing at a joint meeting of the London Section and the Fuel Section of the Society of Chemical Industry on April 4. A summary of the papers read at the Pittsburgh Conference was published in the "JOURNAL" for Dec. 8, 1926, p. 630.]

The trend of present-day thought in fuel matters, as exemplified by the contributions, showed a distinct bias towards the conversion of coal into oil and the application of solid fuel in powder form. At first sight it might seem surprising that America, the land of prolific petroleum production, should show such vivid interest in the problem of producing oil from coal. The reason must be sought in the astounding growth of mechanical road transport. Rating the 20 million automobile engines in the United States at the conservative average of 20 H.P. each, a combined capacity of 400 million H.P. is obtained. The consumption of motor fuel is so large and is increasing so rapidly that the problem of procuring future supplies is a serious one, even if allowance for a large addition by cracking of heavy oils is made. Hence the intense interest taken at the Conference in the liquefaction of coal, the synthesis of hydrocarbons, and the recovery of liquid fuels by carbonization.

Liquefaction of Coal.

Dr. F. Bergius gave an account of the conception, elaboration, and translation into a practical process of his method of direct liquefaction of coal by means of hydrogenation. He restated the considerations which guided him in his early work—viz., that it was necessary to strike a balance between the addition of hydrogen to the coal substance and its destructive distillation. Within a certain range of temperature the velocity of hydrogenation is greater than that of the carbonizing reaction, but at higher temperatures the latter is faster, and finally yields coke instead of oil, even at pressures under which the hydrogen is brought into the closest contact with the coal. When treated at 300° to 350°, a kind of high-melting pitch is produced, which, by continued treatment at 420° and under 200 atm. pressure, is liquefied, giving a yield of from 40 to 70 p.ct. of oil, according to the kind of coal used. From an average bituminous coal, 15 p.ct. of motor spirit, 20 p.ct. of middle oil, 6 p.ct. of lubricating oil, and 8 p.ct. of fuel oil can be obtained. Dr. Bergius showed that economically "Berginization" may be considered in combination with other processes. Gas liberated in the process may be used for town supply, and a Bergius plant may be combined with an ordinary gas-works or coke ovens. The coke produced would be converted into water gas and hydrogen, and the final products of the combination would be oil and a gas of high calorific value.

Prof. Franz Fischer attacks the problem of liquid fuel supply from a different angle. In his paper he gave an excellent, concise summary of the previous work on catalytic reactions of carbon monoxide under high pressure, referring to the manufacture by the Badische Company of "methanol," and to his own method of "synthol" and "synthin" production. Considerable interest was shown in Fischer's account of his and Tropsch's work on the synthesis of petroleum products from water gas at atmospheric pressure. The simplicity of the method, by which, according to the selection and preparation of the catalyst and the control of temperature, the production of methane may be suppressed in favour of liquid hydrocarbons of varying boiling range, outweighs, according to Fischer, the greater bulkiness of the catalyst chambers required. Any gases containing carbon monoxide and hydrogen—*e.g.*, water gas, producer gas, and blast furnace gas—may be used as raw material.

General G. Patart, the French Inspector General of Explosives, presented a carefully prepared survey of the work on the production of liquid fuels from coal, and particularly of his own process of the catalytic synthesis under pressure of alcohols from water gas. Patart's proposals also embrace the suggestion that these processes should be grafted on the ordinary gas-works routine. The water gas of special composition required for alcohol synthesis is to be taken from the ordinary water gas generator, while the residual gases after removal of the alcohol are returned into the ordinary gas mains.

The dictum of the late Sir George Beilby, that "the existing gas-works certainly ought to be the natural nursery for the development of low-temperature carbonization" applies therefore in the view of such pioneers as Bergius, Fischer, and Patart to their respective methods of liquefaction or synthesis.

Powdered Coal.

Prof. A. H. White recorded a laboratory investigation of the instantaneous carbonization of powdered coals on the lines of the work on "cenospheres" of Newall and Sinnatt in this country. The commercial elaboration of this problem in the McEwen-Runge plant was described in an interesting paper by Dr. W. Runge. The plant, which is the third in order of the progressive development, is erected at Lakeside on the premises of the Milwaukee Power Station. It consists of two retorts superimposed one on the other, each about 6 ft. 9 in. in diameter and 40 ft. high, with funnel shaped top. They are heated internally by burning coal gas in auxiliary combustion chambers connected tangentially with the bottom of the retorts, coal being dried and preheated in the upper retort, and carbonized in the lower. The coke is only partially cooled, and is pumped while warm to the boiler house. The plant, which is designed for a throughput of 8 tons per hour, is an extremely interesting one; and, provided removal of dust by the gases, and caking of the coke powder can be avoided, the process should be a promising preliminary to the direct burning of the uncarbonized coal powder.

Low-Temperature Carbonization.

The problem of low-temperature carbonization of compact coal agitates the mind of American fuel technologists no less than that of their European confrères, as was manifested by the dozen papers presented to the conference on the subject. Contrary to the opinion held in some quarters that the provision of a smokeless fuel is of particular interest only to this country, on account of the open domestic fire peculiar to the British home, it is found that this desideratum applies to America with equal force.

The economic aspect of low-temperature carbonization was ably discussed by Dr. Horace C. Porter, whose conclusions tally closely with those submitted by the Director of the Fuel Research Board, and those given in evidence by the writer to the Samuel Commission. The paper by Prof. S. W. Parr, the doyen of American coal investigators, was of particular interest, partly on account of its attractive historical preamble, and partly because the practical process he outlined is based on the thermal pre-treatment of coal (in a rotary drum)—a feature which is the keynote of a number of the proposed methods.

C. V. McIntire described his process, based on Smith's "Carbocoal" plant, which is in active and fairly successful operation at Fairmont, West Virginia. Coal is carbonized while agitated in a primary retort, and the semi-coke is briquetted and reheated to 1000° to 1200° Fahr. in a secondary retort. Harald Nielsen gave a full account of the English "L & N" process and the internally heated rotary retort, and emphasized its capacity of yielding a true primary tar containing good lubricants in its higher fractions, together with a semi-coke which has been successfully burned in powder form. Other forms of rotary plants described were C. B. Wisner's "Carbocite" retort, in which the coal is rolled into coke balls; W. A. Darrah's externally heated drum, based on the German Thyssen process; and the "K.S." double drum type, described in a paper by Dr. F. Mueller (not read). R. B. Parker dealt with the Bussey plant of the internally heated shaft type, similar to Maclaurin's retort and fitted with a reciprocating water-cooled cutter-bar discharger mechanism interlocked with the coal feeding device at the top of the shaft. E. H. Piron's description of the Piron-Caracristi process of carbonizing a thin layer of coal on a conveyor heated by a lead bath is valuable as a faithful account of failure. F. C. Greene described the Greene-Laucks retort, in which the coal is propelled upwards by means of an ingeniously designed worm screw.

Gas Manufacture.

G. M. Gill gave a comprehensive survey of the present methods of British gas-making practice and the economics of the gas industry. W. H. Fulweiler addressed himself to the subject of water gas manufacture, dealing particularly with the Pier process for gasifying coal, in which the fuel bed throughout its cross-section is kept active by a refractory pier in the centre of the generator, thus avoiding an uncarbonized core.

Power Production.

A subject of intense interest to us, in view of the establishment of the Electricity Board and the coming reorganization of the coal mining industry, is Mr. G. A. Orrok's communication on "Mouth of Mine Power Stations." On the basis of concrete examples, he discusses the advantages of proximity of power stations to the fuel supply and to the point of consumption of current, but considers that an adequate water supply is the deciding factor.

Mineral Matter in Coal.

I had the privilege of submitting to the Conference a paper on "Coal and Its Mineral Matter"—the only contribution dealing with this problem. Coal ash forms one of the most serious obstacles to high efficiency in fuel utilization, and is the fundamental factor of distinction between solid and liquid or gaseous fuel. I endeavoured to show the differences in composition and distribution of the ash-forming components of coal, and to trace the part they play in its formation, winning, preparation, cleaning, and utilization. The economic significance of coal ash is beginning to be realized, and the catalytic in-

fluence which inorganic compounds exert on all processes of combustion, carbonization, and hydrogenation is slowly but surely finding recognition.

The Conference proved an unqualified success, and the general tenor of the contributions it called forth gave weight to the opinion that we are on the threshold of a new era in the utilization of coal, and that the possibility foreshadowed of refining the natural product, of concentrating its intrinsic value, and of applying it in novel ways, is rapidly changing our conception of its potentialities.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Origin of Long-Distance Transmission of Gas.

Sir,—Referring to Herr Schafer's letter in last week's issue of the "Journal," I enclose an extract from "The History of the Iron, Steel, and Tinplate Trades," published in 1903. It needs no comment unless the following would be of assistance:

1.—Humphrey Davy, giving evidence before a Parliamentary Committee on May 5, 1809, said: "The production of gas from the distillation of coal has been well known for the last thirty or forty years."

2.—Sir Humphrey Davy died in 1829.

3.—Why not hold a séance at Grosvenor Gardens, or the "Old Cheshire Cheese?" Perchance the shades of Samuel Baldwin Rogers and Sir Humphrey Davy would suggest a way by which the gas industry could exist and prosper in industrial areas, or, at any rate, indicate means by which it might attain the status they would have given it prior to 1827.

J. Mogford.

2, Derwen Road,
Llanishen, Cardiff,
April 9, 1927.

Extract from the "History of Iron, Steel, and Tinplate Trades," by Charles Wilkins, F.G.S., published at Merthyr Tydfil, 1903.

In closing our notice of Blaenavon, some reference is due to the notable men who have figured there, and first the founder. In St. Woollos Church, Monmouthshire, there is a cenotaph erected to the memory of the Worcestershire man whom I have named as one of the founders, if not the founder, of Blaenavon. Dates disagree somewhat, as it is reported he died early in the present century; but this must be an error, as will be seen from the following inscription on his monument:

> To the memory of Benjamin Pratt, Esq., of Great Whitley, Worcestershire, who died at Blaenavon, in this county, May 24, 1794, aged 52 years, and lies interred at Chadley, in Worcestershire. A native of this county, though removed from it in early life, he cherished its remembrance with lively regard; and his last years were successfully occupied in contributing to its prosperity. He was principally concerned in establishing the iron-works at Blaenavon and its vicinity, and was a warm promoter of the Monmouthshire Canal. Soundness of judgment, rectitude of principle, and urbanity of manners eminently conspired to form in him the man of business and the gentleman. He died with pious fortitude, which manifested in his last moments that he was at peace with his God.

The works in the vicinity referred to in the memorial were close by Nantyglo, with which was associated one of the most remarkable and versatile men of Monmouthshire, Samuel Baldwin Rogers, metallurgical chemist, Nantyglo. He may be said to have fully realized as early as 1815 the great proportions to which the railway system of England would expand; and, had his ideas been practically adopted, the earlier and more methodic development of the mineral district would unquestionably have been brought about. He not only recommended at that time the construction of 1000 miles of railroad in England and Wales, but submitted plans and full particulars to prominent engineers in London, and also to influential managers in Monmouthshire and South Wales. For this recommendation all that poor Rogers got was to be soundly laughed at. "He was a dreamer," his suggestions were "those of a madman," and were impossible of practical adoption; and yet before the philosopher died he lived to see between 4000 and 5000 miles of rails laid down, and the railway system full of vigorous promise.

A kindred mind in some respects to that of the iron-works chemist—Dr. J. W. James, Merthyr—suggested many years ago, in the infancy of the Board of Health, that, considering the huge populations growing up in the valley, the increase of Cardiff, Aberdare, and Pontypridd, it would be politic to make the valley of Cwmtaf Fawr, at the head of which is the site of the Cardiff Water-Works, an immense reservoir, or series of reservoirs, and from them supply all the places named. He, too, was laughed at as a dreamer; and still time has justified the wisdom of his suggestion, and Merthyr would long ago, if he had had his way, have been as generous a supplier of the purest water to Cardiff as it has been of the best of coal and the highest brand of steel. One of the best informed of our old colliery managers, now retired to take surveys of life from his garden and his farm, used to suggest that, if the coal basin had been laid out with the precision of a township—streets, crossings, blocks—millions of tons of coal lost by boundaries would have been saved, and the ventilation and drainage been as near perfect as human art and ingenuity could have made it. He was no dreamer.

Mr. Rogers, however, not satisfied with really demonstrating a practical course of things, lost much of his fame by trying to demonstrate an impracticability. His next announcement lies before us in the following shape: "A proposition to ensure a return of 7 p.ct. without risk, by constructing 10,000 miles of railroad, to connect—with the exception of the short sea passage to Antwerp or Flushing—London with Canton, in China, a twelve days' journey only, with ramifications to all the principal cities, towns, and works of Europe and Asia, and to many in Africa also, if thought desirable; by means of which," cries poor old Rogers, bursting into bigger capitals—"roads and a daily post and free intercourse—commercial, social, and philosophical—may be established and permanently maintained over a population of from 600,000,000 to 700,000,000 of people, and the blessings of real civilisation be thus spread over the globe." Some men may be said to live a generation in advance of their fellows. Rogers evidently did in the matter of ordinary railroad development; but in the question of universal railroads and a general world-wide civilization, he went ahead, I fear, a great many generations.

His literary productions were numerous, but chiefly of the pamphlet character. An idea would strike him, and down he would sit and write; and in a short time the work, if of a scientific character, would be brought out by the "Mining Journal, Railway, and Commercial Gazette" office. Then his mood would change, and he would write about the millennium. Rogers had a belief that he should live to see this, by which time all his schemes would have been perfected and in practical working. Then he came out with a tract on recruiting, organizing, and maintaining in full and effective force national armies, and rendering them partially or wholly self-supporting. Another of his ideas was a proposition for establishing Samarias, or Working Benefit Societies, in connection with these, which were to abate the evils of pauperism, slavery, vagabondry, idleness, and crime; and for erecting a "superb, substantial, and convenient stone bridge across the mouth of the River Severn, with a railroad communication between England and Wales," &c. The bridge is there—not as he designed it—and a link between England and Wales is in many a place formed by steel rail; but the Samarias are unknown, and the shades of the evils enumerated by him remain increasing as the population increases—the night side of human nature, apparently to remain to the end.

From such writings as a "Serious Call" to the unconverted or the uncivilized, Rogers next turned his attention to a scheme which astounded everybody. This was put forth in a "letter" which he had printed and circulated at Newport, the title running as follows:

> To the owners and workers of coal mines in Monmouthshire and certain parts of Glamorganshire; to the directors and shareholders of gas-light establishments, situate on a route extending from Cardiff to London, *via* Gloucester, &c.; to the canal and tramroad proprietors and the ironmasters in the district of the country above mentioned; and to the public at large—as a new mode of supplying London and other populous places, and also the Great Western and other railway companies with gas, &c.

Rogers' notion was suggested by the distillation of coal in his laboratory. He had several years before submitted the idea to Humphrey Davy, who was delighted with it, and to Benjamin Hall, of Llanover, and many others, who cordially supported him; but, like most inventors, Rogers carried the matter up to a certain point, until 1841, when it was dropped. Briefly, the idea was as follows:

> To establish at Newport and Cardiff branches for generating carburetted hydrogen and olipant gases from coal, coal tar water, or other proper organic or inorganic material, but principally from coal, and conveying the gases so produced through pipes of suitable dimensions, and in various ramifications, to supply by measure the demand for light all along the route and in the Metropolis. [It is very amusing to see how Rogers summed-up the wonderful results that would be attained and the great sums of money realized.] There are, he exclaims, no less than 800 tons of coal per day left as a refuse at the collieries. The whole of this would suit for producing gas. Then the coke would come in for sale, 1200 tons a day or more, useful for the ports. Then look at the increased traffic on the tramways, canals, and railroads. To get the quantity of gas needed, 600,000 tons of coal would be required! Note the improved royalties that would follow, the increased labour, cutting, and conveying.

And so he goes on piling-up the results; but, fairplay to the old philosopher, there is a modicum of sanity in his dreams.

He anticipated the production of bye-products in the form of tar, ammonia, &c.—nothing of colours (only prussian blue) and sugar, afterwards discovered—and finally wound-up with the benefits of ammoniacal water to vegetation, adding tables of financial results. We can but wonder at the varied ability and keen, far-sighted perception of this wise man of the early iron-works, though regretting that in some of his theories he laid himself open to doubt that the "Bee of Gwent" occasionally got into "his bonnet." Rogers found a true friend in Crawshay Bailey, and under his rule, when at Nantyglo, brought out an improvement of Cort's puddling furnace. Cort's had a bottom of sand. Rogers' improvement was to substitute one of iron; and it was one of old William Crawshay's, of Cyfarthfa, favourite recognitions, when waited upon by Rogers, to salute him as: "Well, old Iron-bottom." Rogers lived to be 80 years of age—a striking proof that brain work is not incompatible with long life—and was up to the seventies often to be seen, a grey old man, in the streets of Newport, pensioned by his ironmaster friends.

REGISTER OF PATENTS.

Light Oils from Washing Gas.—No. 254,287.

I. G. FARBENINDUSTRIE A.G., of Frankfort (Assignees of A.G. FUR ANILIN-FABRIKATION).

No. 13,895; June 1, 1926. Convention date: June 25, 1925.

The patentees point out that for obtaining light oils, particularly benzole and benzene, by washing coal gas or natural gas, tar oil or petroleum oil has hitherto been the chief washing agent. These oils, however, have several other applications; and both on this account and because they thicken somewhat rapidly when used for washing gas, and therefore need constant renewal, they are comparatively costly. The hydrogenized naphthalene which has recently been introduced as a gas washing agent has too low a boiling-point to be satisfactory for extracting benzene and benzole, constituents of which boil at temperatures as high as 180° C.

By the present invention, the practically valueless waste product of the Edeleanu process for refining mineral oils is used as the washing agent for removing light oils from gases. This waste product is the oil which is extracted by sulphurous acid from the mineral oil in the said refining process; it contains the unsaturated hydrocarbons of the mineral oil, and is thereby fundamentally different from the petroleum oils. Owing to its middle position between the paraffins and the aromatic hydrocarbons, it is well adapted for absorbing in high degree both benzene and benzole vapours.

Geysers.—No. 266,979.

EWART, J. H., of Crouch End, N. 8.

No. 17,332; July 10, 1926.

According to this invention for geysers, the taps or cocks for controlling the supply of gas to the main and pilot burners are so arranged that their controlling lever-handles move in parallel planes, and the controlling handle of the water tap of the geyser is a plane at right angles; the gas tap handles being so constructed that, when they are in the turned-off position, that of the pilot burner forms a stop to prevent that of the main burner being turned to the on position, and the handle of the main burner when in the open position prevents the pilot burner from being turned off.

Further, it is arranged that the tap for controlling the supply of water to the geyser is such that its handle, in the normal or turned-off position forms an obstruction in the path of the handle of the tap for the main gas burner, and the turning-on of the latter tap effects the turning-on of the water tap.

Gas Fires.—No. 267,322.

MAIN, R. & A., LTD., and AIRD, K., both of Grosvenor Gardens, S.W. 1.

No. 7791; March 20, 1926.

This invention relates to the "mat" of fuel which is applied to gas fires of the imitation coal-fire class (such as the "Cinderella"); and it provides means for positioning and holding the mat.

The feature of the invention is a metal strip which is screwed to the upper part of the back-plate. The lower edge of the strip is upturned and drilled, or curled over to embrace a wire; and hooks or wires incorporated in the mat are attached to the strip.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for April 13.]

Nos. 9152—9836.

ALDER & MACKAY, LTD.—"Gas meters." No. 9824.
ANDERSON, J.—See Alder & Mackay, Ltd. No. 9824.
BEAVON, A. S.—"Air-gas generators." No. 9580.
BLAKEBOROUGH, R. A.—"Control valves." No. 9789.
BRITISH MANNESMANN TUBE COMPANY, LTD.—"Coating for inner surfaces of tubes." No. 9370.
BRITISH MANNESMANN TUBE COMPANY, LTD.—"Covering surfaces." Nos. 9371, 9372.
BROWN, J. F.—See Blakeborough, R. A. No. 9789.
COOPER, C.—"Drying gases." No. 9618.
HADDAN, R.—"Distilling ovens." No. 9831.
HARTLEY, J. W.—"Apparatus for separating coke from clinker." No. 9249.
HELPS, A. M.—"Hotplates and burners." No. 9176.
HENSHAW, D. M.—See Cooper, C. No. 9618.
HOLLIS, H. H.—"Valves for gas purifiers." No. 9656.
HOLMES & Co., LTD., W. C.—See Cooper, C. No. 9618.
HORSTMANN, A., and HORSTMANN GEAR COMPANY, LTD.—"Gas cocks, &c." No. 9674.
LAING, B.—"Manufacture of illuminating, &c., gases." No. 9523.
NIELSEN, H.—See Laing, B. No. 9523.
SALERNI, P. M.—"Treatment of hydrocarbon gases." No. 9520.
SIMPSON, S.—"Gas meters." No. 9423.
STETTINER CHAMOTTE AKT.-GES. VORM DIDIER.—See Haddan, R. No. 9831.
WHITELEGG, S. H.—"Gas burners." No. 9407.
WOODALL-DUCKHAM (1920), LTD.—"Dust extractors." No. 9363.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

Matlocks Urban District Council Bill: Further Standing Orders complied with.

South Staffordshire Mond Gas Bill: Reported, with amendments.

HOUSE OF COMMONS.

Progress of Bills.

Bognor Gas and Electricity and Commercial Gas Bills: Further Standing Orders complied with; to be read a second time.

Leeds Corporation Bill: Read the third time, and passed.

SOUTH STAFFORDSHIRE MOND GAS BILL.

This Bill (see "JOURNAL" for Jan. 26, p. 190) was before the Unopposed Committee of the House of Lords (presided over by the Earl of DONOUGHMORE, Lord Chairman of Committees) on Tuesday, April 5; and it was ordered that it should await report for third reading.

BIRMINGHAM CORPORATION BILL.

On Tuesday, April 12, the Committee of the House of Commons (presided over by Mr. J. W. W. HOPKINS) which has been considering this Bill, concluded its proceedings and approved the clauses. One of the purposes of the Bill is to extend the boundaries of the city (see "JOURNAL" for Jan. 12, p. 83). Originally it was proposed to extend the boundaries to include the whole of the urban district of Perry Barr; but the Bill, as amended, provides that only part of the urban district shall be included (the West Bromwich Corporation having also promoted a Bill providing for the inclusion of part of the urban district of Perry Barr within the West Bromwich boundaries).

WEST BROMWICH CORPORATION BILL.

The Committee of the House of Commons (presided over by Mr. J. W. W. HOPKINS) which has been considering the Birmingham Bill has also been dealing with the Bill promoted by the West Bromwich Corporation, the purposes of which are to add to the borough area a part of the urban district of Perry Barr, to transfer from the Birmingham Corporation to the West Bromwich Corporation the power to supply gas in that added area, and to enable the West Bromwich Corporation to purchase from the Birmingham Corporation the gas mains, pipes, and other works belonging to the latter in that added area. (The position remains as set out in the "JOURNAL" for Jan. 26, p. 190.)

The provision in the Birmingham Bill, authorizing the alteration of the boundary between the County of Warwick and the County of Stafford, so that the city shall be situated wholly within the County of Warwick, remains.

GREENOCK BURGH EXTENSION BILL.

For some three weeks past a Committee of the House of Commons, presided over by Lieut.-Colonel Sir Joseph Nall, D.S.O., have been considering the Bill promoted by the Greenock Corporation for the extension of the Burgh to include the existing Burghs of Port Glasgow and Gourock, and parts of the parishes of Inverkip, Port Glasgow, and Kilmacolm. There was opposition by the bodies interested. The Bill also proposes to extend the Corporation's limits for the supply of gas to include the areas added to the Burgh; and the intention of the promoters is to amalgamate the gas undertakings at Port Glasgow and Gourock with that at Greenock, concentrating the manufacture of gas at Greenock, at least for the greater part of each year.

Mr. *George Keillor* (Gas Engineer and Manager to the Greenock Corporation, and Past-President of the North British Association of Gas Managers) gave evidence in support of the gas proposals. He said that since 1828, when the gas undertaking in Greenock was commenced, it had gone ahead by leaps and bounds. Since 1913 the gas make had increased by about 55 p.ct.; the make of 1926 being 613½ million c.ft. Photographs were handed to the Committee to demonstrate that the works were laid out on modern principles. The gas-works site comprised about nine acres, and there was plenty of room for extension. The extended Burgh was a highly suitable area to be dealt with by one gas undertaking. At present there existed an 8-in. high-pressure gas main from the Greenock Gas-Works up to the Gourock boundary; and all that would be necessary to deal with that area would be to extend the main from the boundary to the gas-holder station at Gourock. The Greenock Gas-Works were on the borders of Port Glasgow; and there would not be the slightest difficulty in supplying the whole of Port Glasgow from those works. All that was necessary was to provide a high-pressure main to the gas-holder station at the Port Glasgow Gas-Works. The capital expenditure required to link-up Gourock and Port Glasgow would be £11,500. The interest and sinking fund charges on that capital ex-

penditure would add about 0·3d. per 1000 c.ft. to the cost of gas. On the other hand, the concentration of gas manufacture at the Greenock Gas-Works would result in economies; and more than sufficient would be saved on the cost of production to meet the standing charges on the extended high-pressure main. He estimated that the economy in cost of production alone resulting from concentration of manufacture at Greenock would be 1·09d. per 1000 c.ft.

The plant existing at the Greenock Works to-day was sufficient to deal with the supply of the three Burghs. The daily make in Greenock last year was 2,664,000 c.ft.; in Port Glasgow, 366,000 c.ft.; and in Gourock, 300,000 c.ft.—a total of 3,330,000 c.ft. The available producing capacity at the Greenock Works was 4½ million c.ft. per day, so that there was sufficient plant to make the whole of the gas required for all three Burghs, and leave a reserve of over 1,100,000 c.ft. The concentration of gas manufacture at Greenock would enable the amount of stand-by plant to be reduced. The Greenock plant was modern, and in excellent condition. The Port Glasgow Gas-Works were modern, and of ample capacity for the requirements of that Burgh. The Gourock Works were modern in part, but in his opinion were not adequate for the present requirements. During the last five years the average amount spent per 1000 c.ft. on maintenance of works at Greenock was 5·34d.; at Port Glasgow, 1·47d.; and at Gourock, 1·58d. The Port Glasgow Works were newer than the others, so that it would be expected that less would be spent on maintenance; but he did not regard the figure of 1·58d. per 1000 c.ft. in the case of the Gourock Works as a usual one. It appeared low.

With regard to the distribution of gas, there was a 24-in. low-pressure main through the centre of Greenock, and there were various compressors for distributing to different parts by means of a high-pressure main. There were many other mains in various parts of the Burgh. The average leakage in Greenock between 1913 and 1926 was 3·22 p.ct.; in Port Glasgow, 11·9 p.ct.; and in Gourock, 7·53 p.ct.

The CHAIRMAN asked what was the consumption per head of population in the three Burghs.

Witness said the average consumption per consumer in Greenock was 31,350 c.ft.; in Port Glasgow, 16,517 c.ft.; and in Gourock, 24,543 c.ft. for the year ended May, 1925. The Port Glasgow Works were opened in 1921, and their capacity was equal to 650,000 c.ft. per 24 hours. The capital costs were high at the time they were built, and in consequence the standing charges per 1000 c.ft. were somewhat high. That had had a bad effect upon price, and the price had had an effect upon consumption. The amount of gas they made in the year 1913-14 was 73,263,000 c.ft., and in 1926, 73,261,000. The average price in 1914 was 2s. 11d., and in 1926, 5s. 11·82d. The average price in Greenock in the year to May, 1926, was 2s. 6d.

Discussing the most economical way of supplying the whole area if the three Burghs were amalgamated, witness said there was sufficient plant at Greenock to supply the whole area, but he was of opinion that, inasmuch as the Port Glasgow Works were new, and well equipped with a railway siding, and in order to prevent the rapid decay of the works which would occur if they were closed down, they should be kept in operation for perhaps two winter months in the year, in order to help the supply in the whole area. By that means, as consumption increased, capital expenditure at Greenock would be obviated for some years to come. It was proposed to close the Gourock Works. The outstanding loan debt at Gourock, he believed, was £43,000. He estimated that the structural value of the plant he proposed to keep in operation in Gourock—namely, the gasholders, station meter, station governor, 10¾ miles of main pipes, the service pipes, the ordinary meters, slot meters, and gas cookers—was about £30,000. The Gourock Works could not be operated economically. They had no railway siding; and the accounts for 1926 showed that the cost of producing gas in the holder was 8½d. per 1000 c.ft. higher than in Greenock. Further, when the holder was not fully cupped, the pressure fell, and there was not enough to supply the needs of the people. In his opinion, if the Bill did not go through, Gourock in two or three years' time would be obliged to spend a considerable sum on increasing their plant. His estimate of the amount which ought to be expended on the undertaking at Gourock to make it effective was £19,762, apart from any increased demands upon the undertaking. That would be equal to 5·14d. in interest or capital and sinking fund charges on their present sale. On the other hand, by a high-pressure main of the Greenock Corporation, he could supply to the Gourock holders sufficient gas to maintain the supply in Gourock.

The average price in Gourock last year was 4s. 4d. per 1000 c.ft. In Greenock, gas was sold on the thermal basis, but it was sold on volume basis in Gourock and Port Glasgow. It was not his experience that the calorific value of the gas was kept up to the standard in Gourock and Port Glasgow. The standard calorific value in Port Glasgow was 575 B.Th.U. per c.ft., but the tests made by his staff up to the end of the last financial year showed that the calorific value of the gas supplied was 389 B.Th.U. per c.ft. He had never heard of gas examiners in Port Glasgow and Gourock, but there was an independent gas examiner in Greenock. In Gourock there was a standard of 14 candle power, equal to a calorific value in the neighbourhood of 575 B.Th.U. per c.ft., but up to last May they had been supplying a 419 B.Th.U. gas. Last week it was about 356 B.Th.U. If the areas were united, they would all be under the one thermal basis, and the gas would be subject to test by an independent gas examiner.

If the three undertakings were amalgamated, and the amalgamated undertaking took over the debts of all three, the capital expenditure incurred would be the £11,500, already referred to, and there would be no more capital expenditure on manufacturing plant. If the works remained apart, expenditure would have to be incurred at Gourock. There was no room at the Gourock Works for extensions, however; and in his opinion it would be necessary to shift the works to a new site.

With regard to the price of gas as supplied by the amalgamated undertaking, he said that after taking over the capital indebtedness of the Port Glasgow and the Gourock undertakings, allowing for taking-over the outstanding debit balances on debit account of both Burghs, and even allowing for reasonable coal strike losses, he could give a flat rate of 3s. 3d. per 1000 c.ft. over the whole of the area. In that event the reduction in Port Glasgow below the 1926 average rate would be 2s. 8·82d. per 1000 c.ft., and in Gourock 1s. 1·06d. The annual saving to Port Glasgow would be £9492, and to Gourock £3678. He was certain that there would be a large increase in consumption in Port Glasgow and Gourock immediately the amalgamation came about. The average consumption there was only half that in Greenock, yet the consumers were the same class of people—the working classes, with slot meters. He had allowed for some of that increased consumption in the figures he had put before the Committee. He expected the sale of gas in Port Glasgow after amalgamation to be 82,720,000 c.ft. The sale in 1926 was 69,410,000 c.ft.

The CHAIRMAN asked if it was proposed that there should be an increase in the price of gas in Greenock itself.

Mr. W. E. TYLDESLEY JONES, K.C., asked witness whether, if a flat rate were charged throughout, it would mean an increase in the price in Greenock.

Witness replied that there were increases due to coal strike losses. Since the coal strike the Greenock Corporation had had to increase the price by 10d. per 1000 c.ft., and the price in Gourock had increased by 1s. per 1000 c.ft. since May, 1926. The average price in Greenock in May, 1926, was 2s. 6d. If the Greenock Corporation had been considering this question at that time, they would have been basing their figures on 2s. 6d. or 2s. 7d. per 1000 c.ft. The 3s. 3d. rate now proposed was to a large extent due to the coal strike losses.

The CHAIRMAN asked what would be the effect on Greenock.

Witness replied that the consumers in Greenock would pay 3s. 3d. This would fall to 2s. 7d. immediately the coal strike losses were worked off, and the whole area would benefit equally in that reduction. Thus the saving to Port Glasgow and Gourock would be larger than was indicated by the figures given previously. The present price in Greenock was from 3s. 3d. to 3s. 4d. The present price to the ordinary consumer in Port Glasgow was 5s. 6d., and in Gourock 5s. 2d., so that there would be a saving of 2s. 3d. and 1s. 11d. respectively, when charging a flat rate of 3s. 3d.

Mr. GRAHAM ROBERTSON (for the Port Glasgow Corporation), cross-examining, asked if Greenock could not sell gas to Port Glasgow without annexing Port Glasgow, and whether the advantages to which witness had referred might not accrue by private bargain between the two communities, without annexation.

Witness agreed that they could do so easily. He agreed also that the Port Glasgow Works were excellent, and suited for the supply of Port Glasgow.

Mr. ROBERTSON asked whether, in 1914, there was a surplus capacity at the Greenock Works which would have enabled them to supply Port Glasgow.

Witness said he was not in office at that time, but he believed they could have supplied Port Glasgow then.

Mr. ROBERTSON said that at that time Port Glasgow had proposed taking gas in bulk from Greenock, but Greenock had made no reply to the proposal. Accordingly, new works were built subsequently at Port Glasgow at high cost, because when they were erected the prices were near the peak.

Witness agreed that this was so, and that the high price of gas to-day in Port Glasgow was the result of the capital expenditure incurred at that time.

Mr. ROBERTSON asked if witness was not optimistic in suggesting that he could supply the whole area at a flat rate of 3s. 3d., after taking over the capital indebtedness of the Port Glasgow and Gourock undertakings.

Witness said he was not. His estimate showed that he could supply the whole of the area, when normal conditions were restored, at 2s. 7d. He was anticipating an increased consumption in Greenock as well as in Port Glasgow and Gourock.

Mr. ROBERTSON asked what was the capital indebtedness on the Greenock, Port Glasgow, and Gourock undertakings.

Witness said the capital indebtedness on the Greenock undertaking was £112,000, on the Port Glasgow £106,500, and on the Gourock about £43,000.

Mr. ROBERTSON asked if it was suggested that the capital indebtedness of the Gourock concern was going to be increased from about £100,000 to about £250,000, and yet the price of gas would be reduced over the whole area.

Witness replied that the reduction would be in Port Glasgow and Gourock only. The price in Greenock, in normal circumstances, would probably be 1d. more—*i.e.*, 2s. 7d. instead of 2s. 6d., which latter was the price charged before the coal strike.

Mr. ROBERTSON asked whether the ratepayers in Greenock would agree to be penalized an extra 1d., and whether he would undertake that the ratepayers in Greenock would pay the extra 1d. in order to give Port Glasgow and Gourock a reduced price.

Witness replied that he could not say.

Mr. ROBERTSON said that if not, there would be a differential rate for gas for the added area, and the saving would be less than had been indicated.

Witness agreed.

Mr. VIANT (a member of the Committee) asked if witness had made any allowance in his calculations for the possible use of electricity, and the effect that this might have on the gas undertaking.

Witness said his experience was that, wherever electricity had been introduced, the consumption of gas had gone up. He did not think he could point to a single town where the consumption of gas had gone down since electricity had come along.

Mr. VIANT asked whether gas or electricity was being installed for lighting purposes in the houses being erected.

Witness replied that electricity was introduced for lighting purposes, and gas for heating and cooking.

By Wednesday, April 6, the promoters completed their case, and it was decided that the Committee should adjourn, and that the opposition be dealt with after the Easter recess.

MISCELLANEOUS NEWS.

HARROGATE GAS COMPANY'S EXTENSION OF AREA.

At an extraordinary general meeting of the Harrogate Gas Company on April 12, provisional agreements were confirmed for the purchase by the Company of the gas undertaking of the Knaresborough Urban District Council and the business of the Boroughbridge Gas Light Company; and the Directors were authorized to apply to the Board of Trade for a Special Order, as well as to issue additional capital to the extent of £80,000. These contracts, together with others previously approved, make provision for a district of supply extending from the north-west to the south-east 29 miles, and 17 miles across at its widest point. By the purchase of the small undertakings within the area, the Company are taking over already well-established businesses capable, by more efficient service, of considerable expansion, with several other well-populated parts which lend themselves to profitable development. As showing the wisdom of this policy, the Chairman pointed out that in June, 1925, the Company took over the small works at Pateley Bridge, where the annual consumption by 256 consumers was 2¼ million c.ft.; being an average of 9000 c.ft. per meter. The price was 6s. 8d. per 1000 c.ft. In six months they were able to reduce the price from 6s. 8d. to 4s. 10d. Last year they had on this extension 736 consumers, and a consumption, in round figures, of 9 million c.ft. The price to be paid for the Knaresborough undertaking is £16,000, *plus* the cost of reconstructing a holder, which is estimated at £2300, giving a total sum of £18,300. The cost of the Boroughbridge undertaking is £4750. The present consumption of gas from the two undertakings is approximately 37 million c.ft. The purchase price therefore works out at £623 per million of output. The cost per million on this purchase is approximately the same as the cost per million of output on the Company's existing capital. While the contract with Knaresborough gives the Company the monopoly of the public lighting by gas, it also secures to the private consumers of gas there a supply at the price charged in Harrogate, which is equivalent to a reduction of 1s. 10d. per 1000 c.ft. The price of gas at Boroughbridge is 6s. 5d. per 1000 c.ft. The Company anticipate that, as soon as they are able to connect-up and get the consumers' apparatus in order, they will make a substantial reduction in the price to consumers there.

GASHOLDER SITE AT WELLING.

A Local Inquiry.

An inquiry was held on Tuesday, April 12, in the East Wickham and Welling Memorial Hall, by Mr. James F. Ronca (Director of Gas Administration, Board of Trade), into an application by the South Suburban Gas Company for a Special Order under section 10 of the Gas Regulation Act, "to enable the Company upon scheduled land to erect, maintain, alter, improve, and renew works for the storage of gas, with all necessary machinery and apparatus connected therewith, and do thereon all such acts as may be proper for storing gas and for supplying gas within the limits in which they are for the time being authorized to supply gas."

Mr. Jacques Abady (instructed by Messrs. Blyth, Dutton, Hartley, and Blyth) represented the Company; and there were also present Mr. Wilfrid Wastell (Secretary), Mr. John Terrace (Chief Engineer), and Dr. C. F. T. Blyth.

A number of objections to the proposed site had been notified; and those appearing at the inquiry were Mr. T. E. Baynes, Clerk to the Bexley Urban District Council; Mr. O. J. C. Bromfield, on behalf of the East Wickham and Welling Ratepayers' Association; Mr. Sydney A. Smith, for Mr. Mortimer, a property owner; the Rev. Rupert Williams, representing Foster's Endowed School; Mr. Creamer, for the Kent Education Committee; and Messrs. A. S. Willis, F. E. Bryant, and B. L. Gibson, occupiers of houses in the vicinity of the land which formed the subject of the proceedings.

The Case for the Company.

Mr. Abady said that a gas company could not acquire land compulsorily, except by authority of a Special Act of Parliament, the procuring of which was a lengthy and expensive matter; but powers were given to companies—and had been given to this Company—to acquire lands by agreement, and to use those lands when acquired. The South Suburban Gas Company possessed large unexhausted powers for the acquisition of land by agreement. Section 32 of their Act of 1918 empowered them to hold up 25 acres; and they had other powers besides those conferred by this section. There was no question that, in acquiring the piece of land now in question by agreement, they were acting not only in accordance with their powers but in accordance with the usual method adopted by statutory companies upon whom were cast the burden and duty of giving a public service to the community. But though a company such as this had the power to acquire land by agreement, they could not use that land for the purpose of making or storing gas except in accordance with authorization contained in the Acts which were incorporated in the Company's own Act; and by those Acts and the regulations made thereunder it was necessary that when the Company desired to use land for storing gas they should give notice of their intention to everybody who owned or occupied a house or premises within 300 yards of the site. Any person to whom such notice had to be given had a right to appear as an objector. The district which they were now considering was one which had developed with great rapidity; and it was at the extreme limit of the Company's area of supply. The gas required there was supplied from Crayford, which was 3 miles away. The mains ran along Watling Street, which subterraneously was crowded with the mains and cables of different authorized undertakers to such an extent that beyond a certain point the 12 in. main had to give place to one of smaller diameter. The interests of the inhabitants were, of course, those of the Company, who had not the least desire to do anything but serve them with an adequate supply of gas. In their efforts to do nothing which would leave behind it any sense of injury, they had put themselves to great trouble to find a site which would cause the minimum of annoyance to anybody.

The reason the holder was required was because at times of greatest load—particularly on Sundays during the cooking hours—the pressure, despite all the efforts of the Company, was insufficient for the proper service of the consumers. The local Council admitted that the pressure was at certain periods inadequate; and Mr. Terrace would submit that for engineering reasons the only practical method by which the difficulty could be overcome was by erecting a holder into which gas could be pumped. This would be utilized to augment the pressure at such times as was necessary. The services of a firm possessing first-class knowledge of land in the neighbourhood were secured, and one or two sites were discussed, with the result that the one which was the subject of the inquiry was purchased. He submitted that, taking everything into consideration, this site was an eminently suitable one, and one which would cause æsthetic annoyance—because this was all the annoyance that would be caused—to the minimum number of persons. It seemed impossible to find another site where connection with the mains would cause the holder to function for the purpose for which it was intended, and where its erection would interfere so little with the future development of the neighbourhood. It was a triangular piece of land, having on one side a railway embankment, separated from it by a pathway, on another side the back gardens of Mortimer Terrace, and on the third side the grounds of Foster's School. The Company proposed to surround the site with an oak fence, and to erect upon the land a holder 36 ft. in diameter, with two lifts, each of 13 ft. 6 in. The framing of the holder would thus extend about 27 ft. above the ground level. It was also proposed to build a small room, which would contain a 2 or 3 H.P. gas engine and pump for filling the holder, together with the necessary valves and governors for distributing the gas. The filling would take about half-an-hour. Thus actual working operations would be carried on there only at intervals; and even when this small gas engine was running, it would be less objectionable from the point of view of noise than the trains or trams passing the spot. If it was thought that the amenities of anyone concerned could be improved thereby, the Company would be quite willing to plant trees round the site, or to fall in with any other reasonable suggestion of that kind.

Mr. *John Terrace*, M.Inst.C.E. (Chief Engineer of the Company), bore out Counsel's statement, and produced a photograph of a holder at the Crayford Works which was similar to the one it was proposed to erect at Welling. It was pointed out by him that the new storage must be in reasonable proximity to the largest existing main, and that this limited the area within which a site would be suitable for their purpose. He did not consider that any nuisance or annoyance would be created by the erection of the holder.

The Opposition.

The Rev. Rupert Williams said the case had been presented very fairly. It was the fear of what these powers might mean in the future that had caused the Governors of Foster's School to be so uneasy. They were not afraid so much of what was proposed now, as of what it might lead to later on. At the same time, they did not want a gasholder so near them as this would be.

Mr. Smith also urged that what it was now proposed to do might be only a beginning, and that anything done later on to increase the storage capacity would increase the damage which the present scheme must cause his client.

Mr. Baynes said that, while the Council recognized that provision for increased pressure in the district must be made, they were anxious to do everything that was possible to prevent gas being manufactured on the site.

Mr. Ronca pointed out that by the Order there was no power given to make gas.

Mr. Baynes said he would like the Company to be definitely prohibited from manufacturing gas upon the site.

Mr. Creamer said the Kent Education Committee were all for free and open surroundings for schools, and for adding as far as possible to the refinement of the locality. It could not be said that the proximity of a gasholder would increase the attractiveness or beauty of the school site.

Mr. Bromfield remarked that the Ratepayers' Association secured over 800 signatures to a petition against the scheme. It was signed by the great majority of owners in the surrounding area. The site was in a rapidly growing locality. The Association agreed that a holder, or some other method of improving the pressure, was necessary, but why put it in the worst position possible, when there must be an unlimited number of sites available, just as convenient, outside the busy area?

Mr. Abady, in his reply, again urged that the holder was necessary for a proper service to the consumers, and that the position selected for it was where it would do the least harm to the smallest number of people.

Issue of Capital Stock of the Lewes Gas Company.—The Directors of the Company have instructed Messrs. A. & W. Richards to offer for sale by tender £15,000 additional capital stock, ranking for a maximum dividend of 7 p.ct. The minimum price of issue is par; and tenders should reach Messrs. Richards, 37, Walbrook, E.C. 4, not later than eleven o'clock on Tuesday, April 26.

GAS AT A SHEFFIELD EXHIBITION.

The accompanying two photographs are of the stands of the Sheffield Gas Company at the recent "Sheffield Independent" Ideal Homes Exhibition, which was held in the Edmund Road Drill Hall from March 29 to April 9.

The stands proved of great interest to the public, as they presented gas labour-saving devices suitable for every home. By popular vote, the Company were awarded a silver medal for the most interesting display.

From the photographs it will be perceived that the lay-out was in two sections. One of the stands represented a complete hot water outfit capable of supplying abundant hot water in the home. The entire installation, which was in actual operation, consisted of circulator and shower attachment, bath, wash-hand basins, and geysers, together with a model demonstration set. The other stand was devoted to an exhibition of the latest lighting and heating fittings, which were shown in an artistic manner.

COLOMBO GAS AND WATER COMPANY, LTD.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Company was held at the Offices, 148, Gresham House, Old Broad Street, E.C., on Friday, April 8—Mr. Strachan C. Clarke (Chairman) presiding.

The Secretary (Mr. A. C. Pullen) read the notice convening the meeting and the Auditor's report.

The Chairman: Gentlemen, a copy of the report and statement of accounts having been sent to all the shareholders, I will ask you to take them as read. I mention first with regret that Mr. William Cash, whose services we always valued highly, is resigning from the position of our Auditor. A proposal will be placed before you for the election of Mr. W. Cash, Junior; and if passed it will mean that three generations have acted for this Company in that capacity.

Our business during last year showed continued progress, and we sold nearly 17 p.ct. more gas than in 1925. I would draw to your special notice that the gas used in Colombo for lighting purposes goes ahead steadily year by year, and in 1926 was 51 p.ct. more than it was six years previously. Details of lighting installations carried out during last year and for the first two months of 1927 are on the table. These lists are of much interest; and the one for last year shows 1445 gas lighting points, excluding public lighting, market extensions, and so forth. The number of cookers in use during the year increased by 61 p.ct. under our scheme for fixing them entirely free; and I think you will agree with me that the capital being expended thereon is fully justified.

I mentioned at the last annual meeting that one of the holders was to be remodelled and enlarged in accordance with a scheme prepared by the Company's Engineer and Manager. This work has proved an entire success; and another holder is at the moment being renovated and increased to three times its former capacity under a similar scheme of Mr. Johnson's. For about £11,000, we are rebuilding two very old holders (which work was absolutely necessary), and at the same time increasing their storage capacity by 285,000 c.ft. A holder of this size would cost about £13,000, *plus* cost of land, &c.; and you can thus form an idea of the great economy effected. The many thousands of pounds saved will be very useful for cookers, mains, piping, &c. Other additions were effected during the year, including a new scrubber put together by our own workmen on the works. I assure you every effort is made for economy coupled with proper efficiency; the works being really a model gas-works.

Reference to the capital account will show that we paid off debentures amounting to £1350, leaving our debenture debt at £2900. The additions include part of expenditure on No. 2 holder, with part cost to Company for extending our mains southward, first to Dehiwela and then to Mount Lavinia; our proposals on these schemes having been accepted by the local authorities. The Mount Lavinia scheme is now completed.

The make of gas per ton was over 18,000 c.ft., of 450 B.Th.U. As the cost per ton was largely lessened, we are able to show, for these reasons, a considerable diminution in coal cost, in spite of the large increase in business. We have contracted for our requirements to the latter end of 1929, and should be able to show some further decrease in cost per ton if freight rates are favourable.

In the working expenses, maintenance of works shows a rise of Rs. 6185, due to more work carried out. Trade and general charges account is practically doubled, as we paid Rs. 9378 more for advertising, bought a motor-car to help the Assistant Engineer in distribution work, and also a motor cycle for another official. We paid the medical expenses, &c., for Mr. Bird, our able Accountant, who has been with the Company since 1909. He had a severe illness, and I am happy to say has quite recovered.

As regards advertising, the Manager gives special attention to propaganda work; and specimens of his designs, advertisements, &c., are in another room for inspection. Fixing cookers account increased to Rs. 22,327. This is for cost of running piping free to consumers taking cookers on hire; the hire rate being R. 1 per month.

A new account appears—viz., Provident Fund for Staff, Rs. 11,042, representing the initial cost and cost for the year of a provident fund for all our local European officials and clerical staff. The Manager considers that the bonus scheme has done much to promote good feeling between employers and employees; and the Board have started the provident fund as further evidence of their desire to benefit the staff.

On the credit side of the revenue, gas rentals show an increase. We reduced our gas rates in April last by 1s. for lighting and 8d. for heating, which largely nullifies the effect of the extra gas sold. Residual products are slightly less; more coke and tar was sold, but at reduced prices. The total net receipts are, as you see, 92 p.ct. on coal cost, and compare with net receipts of 50 ⅓ p.ct. on coal in 1920. I mentioned at last year's meeting that, commencing from the then current month of April, we hoped and expected that payments for residuals would amount to more than the cost of coal. I am now able to say that the gross revenue from residuals amounted to over 100 p.ct. on coal cost for the whole of 1926. This surely unique position has been fought for and worked for very keenly. The credit

to gas fittings is higher, on account of more installations carried out. The credit to exchange has been reduced from £2742 to £909. The reason is that, whereas the difference in 1925 between remittances home and shipments to Colombo was £23,000, the difference for 1926 was only £9000. Coal in stock and in transit was £3774 more, which helped to lower remittances home. The assets remain in the Company's books at 1s. 4d. per rupee.

I think these comments are all that I need make on the accounts, except to just mention one rather anomalous feature of the Company's working. Under agreement with the Municipal Council, we base our price of gas upon a sliding-scale, so that when the cost of coal goes up the gas rate is increased, and *vice versa*. But we find in practice that a low cost of coal is to the Company's disadvantage as regards profit, and business must be materially increased to compensate. Of course, we shall continue constantly our endeavours to make reductions in gas rates.

The balance of net revenue is £30,955 7s. 8d., and the Directors recommend a final dividend of 3½ p.ct. on the preference shares, less tax, and a final dividend on the ordinary shares of 5 p.ct., free of tax; also that £10,000 be added to general reserve. The general reserve account will then stand at practically the same figure as before the issue of bonus shares in 1925.

From advices just received, our output of gas for the first three months of 1927 has increased by 28 p.ct. over the corresponding period of 1926, and the gas made per ton was 19,000 c.ft. The sale of gas for the first quarter was thus 55 millions, as compared with 43 millions. The extension of gas lighting to Dehiwela, and now to Mount Lavinia, takes our system of mains to about 10 miles from the gas-works along the coast line in a southerly direction.

Ceylon has continued its prosperity. As regards the hydro-electric scheme, latest advices appear to indicate that the Government will come to an arrangement with the Electric Company for the purchase of the Electric Company's plant. As I said at the last meeting, we are doing all that is possible to consolidate our position at Colombo before the scheme is actually working. We understand that a Government offer for purchasing the Colombo Electric Undertaking at the price of £240,000 is now under consideration here.

The effect of the conservative policy followed by the Board for many years in the past has been more than justified. We have bought land at Greenlands, and put up a new holder there; and we shall this year have a storage capacity of 770,000 c.ft., as compared with 310,000 c.ft. in 1919. A large increase in retort capacity has been made, and machinery for charging same erected. These are only some of the additions to the works; and the value of your property has been vastly increased in recent years. Not one penny of fresh capital has been raised to pay for improvements since 1900; and our investments at Dec. 31 were more than double the amount of the bank loan.

I conclude, as usual, with a special reference to Mr. Johnson, our Engineer and Manager at Colombo. From what I have said about the quite exceptional working results, schemes for the reconstruction and enlargement of the holders, residual results and material economies effected, you will agree that I cannot speak too highly of his whole-hearted and exceedingly efficient work for the Company.

With these remarks, I have pleasure in moving that the report and accounts be received and adopted.

Mr. John G. Wardrop seconded the resolution.

The Chairman having replied to questions regarding the Provident Fund, then put the motion to the meeting, and it was carried unanimously.

The Chairman then moved the following resolution—viz.:

> "That a dividend for the year ended Dec. 31, 1926, at the rate of 7 p.ct. per annum upon the preference shares, less income-tax, and 10 p.ct. per annum upon the ordinary shares, free of income-tax (both less interim dividend paid Oct. 1, 1926), be and is hereby declared, the warrants to be payable on April 13, 1927."

This was seconded by Mr. Robert H. Glen, and carried unanimously.

Mr. John G. Wardrop then proposed the re-election of Mr. Strachan C. Clarke as a Director, stating that it was a very great pleasure to him to propose the re-election of the worthy Chairman, and that it needed no words of his to convey the feeling of the Company towards Mr. Clarke.

Mr. Alex. A. Johnston seconded the resolution, which was unanimously carried; and the Chairman expressed his thanks for re-election.

Major Heriot R. Glen proposed that Mr. William Cash, Junior, M.A., F.C.A., be elected as Auditor for the ensuing year, which was seconded by Mr. A. E. Hayes, and unanimously carried.

The Chairman then proposed a vote of thanks to the staff in Colombo and London, saying that all knew the zeal with which the worthy Secretary proceeds with his duties and the attention given by him to the Company. He remarked that, so far as is possible, the Company had now almost the ideal staff at Colombo. He had much pleasure in proposing the vote, particularly naming the Manager and the Secretary in London.

Mr. A. E. Hayes seconded the motion, and hoped that it could go out to Colombo as coming from the other side of the table.

The resolution was unanimously carried, and the Secretary briefly responded.

The proceedings then terminated.

HONG KONG AND CHINA GAS COMPANY, LTD.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Company was held at the Offices, 148, Gresham House, Old Broad Street, E.C., on Friday, April 8—Mr. Robert H. Glen, F.C.A. (the Chairman), presiding.

The Secretary (Mr. A. C. Pullen) read the notice convening the meeting and the Auditors' report.

The Chairman: Gentlemen, copies of the report and statement of accounts having been sent to all the shareholders, I will ask you to take them as read. I mention with regret the decease of the Hon. P. H. Holyoak, who became Chairman of our Local Committee in 1925. Mr. W. L. Pattenden, of Messrs. W. R. Loxley & Co., a well-known local business house in the Colony, has undertaken the office; and the Board are indebted to Mr. Pattenden for help he has afforded to them.

The troubles through which the Colony has been passing resulted in many of the big firms being brought to the verge of bankruptcy, and in some cases to actual failure. Notwithstanding this state of affairs, we increased our sales at Hong Kong last year by 10½ million c.ft.; Kowloon sales remaining as before. I am pleased to say that the first two months of this year show satisfactory increases in business at Hong Kong. The Company's peak year there was in 1913; and we have now regained the trade lost since then, besides establishing by 1924 a fair business at Kowloon. In consequence of the unfortunate condition of some parts of China, troops are either being stationed at Hong Kong or are passing through to the affected districts on the main land. We are informed by our Manager that at the end of March the sales of gas were largely increasing because of this and other factors. I have before stated that our works at Hong Kong are planned for a much larger manufacture of gas; and we hope the demand will grow at a still more rapid rate when affairs in China become normal.

The number of street lamps lighted by gas at Dec. 31 was 2286—an increase of 62. This branch of our business has long received our special attention; and I think I may say that the street lighting compares very favourably with that in other colonies. We are now engaged upon a proposition for further improving the lighting of certain roads at Kowloon. During the year we sold or supplied on loan 2104 "Surbiton," "Elite," "Pyrol," and other lamps, &c., so private lighting still goes ahead. We sold or fixed on loan 1647 cookers, grillers, geysers, boiling rings, &c.

Turning to the accounts, land, works, and plant show an increase of £14,128, mostly accounted for by the balance cost of water gas plant Kowloon, new mains, &c. Of the £14,128, £10,028 was for Kowloon without taking into account the meters, cookers, &c., the cost of which appears elsewhere. The Board feel that we should be properly and reasonably prepared for a hoped-for growing trade at Kowloon.

In the revenue account, cost of coal fell from $223,694 to $172,984. The quantity used was 1272 tons less, and was mostly Yubari; only very little Yorkshire being carbonized. We are now experimenting with Indian Desherghur coal, a coal which gives excellent results in other Eastern works. The average rate per ton for 1927 will be less, and the strenuous efforts of many years for economy in coal matters will, of course, be continued. The extra cost for C.W. gas is due to larger output.

Working expenses are rather higher. Among the many heads comprised here is discount account, a sliding-scale for which, ranging from 2½ to 12½ p.ct. to gas consumers, was introduced as from Jan. 1, 1926. There is no doubt that this scheme for discounts has been very helpful. Retort maintenance is down; there were considerable expenses under this head in the previous year at Kowloon. Maintenance of mains is up, consequent upon repairs necessitated by the heavy rainstorm in July last. The increase in works maintenance is more than accounted for by retubing the works condenser. Bad debts were considerably increased, a result of the abnormal times; and this matter has been, and is still, engaging constant attention.

Showroom expenses were about the same. The Company's showrooms in Des Voeux Road has been useful for demonstrating the use of up-to-date appliances, for receiving payments of accounts, and for the Company's business generally. Commission was much less, as the arrangement with Messrs. Lane Crawford was discontinued when the new showroom was opened. The debit for provident fund is less, because last year's amount included the initial cost. The Board feel that this fund and the bonus scheme should foster good feelings between employers and employees. Visit of Director to Hong Kong, $4238.39, is for the balance of Mr. Leonard Askew's expenses visiting Hong Kong.

Gas rentals advanced from $513,906 to $525,214. The figure this year has been lessened by extra allocation to public lamp maintenance account. Residuals account, as usual, is not quite satisfactory; but I am pleased to say that coke sales are such that we cannot now meet the demand, so the price has been advanced to $25 per ton. For many years we have struggled hard to get our residuals on a better basis; and I can reasonably say that at long last our efforts are meeting with success.

Exchange has gone against us for the year. The average rate was 2s. 2⅛d., as compared with 2s. 3⅛d., and the rate on Dec. 31 last was 1s. 11⅛d., as against 2s. 4⅛d. at end of 1925. We have realized during the year £14,000 of War Stock and £4000 of old investments to meet capital expenditure. Interest account becomes a debit instead of a credit, as we had loans from the Bank, and, of course, less interest coming in. I think further comment is not needed on the accounts. The balance of net revenue is £47,788 19s. 9d., and a dividend for the year of 10 p.ct., free of income-tax, is recommended, *less* the interim dividend of 5 p.ct. paid in October last. The

year has been one full of strain; and I trust that our hopes for permanently improved business conditions will be fulfilled.

One further matter I would refer to—viz., the question of our Articles of Association, which are really antiquated, as most of them stand as they did at the time of the Company's incorporation in 1862. For example, we are allowed to borrow from the Bank not more than £5000; and other difficulties occur from time to time. Your Board propose to have the Articles brought thoroughly up to date. At or about the time of our next annual meeting, we hope to submit the new Articles to you for approval. With these remarks, I have pleasure in moving that the report and accounts be received and adopted.

Mr. STRACHAN C. CLARKE seconded the resolution, which was unanimously carried.

The Chairman then moved the following resolution:

"That a dividend at the rate of 10 p.ct. per annum, free of income-tax, be declared for the year ended Dec. 31, 1926, *less* interim dividend paid on Oct. 13, 1926, the warrants to be made payable on April 13, 1927."

This was seconded by Mr. LEONARD ASKEW, and carried unanimously.

The re-election of Mr. Robert H. Glen as a Director of the Company was proposed by Mr. STRACHAN C. CLARKE, who remarked that only those who had the pleasure of working with Mr. Glen could understand the interest he takes in the affairs of the Company and the time he devotes to same. Things in China had been very very difficult for some years past; and he should say from business experience with China that for something like six years there had been more or less a position of civil war somewhere or other in that large country; Canton, which is very near to Hong Kong, in the last two years appearing to be the boiling-over point of the whole world. With all the difficulties experienced, the Company, under the able guidance and lead of Mr. Glen, had done remarkably well considering everything.

The motion was seconded by Mr. LEONARD ASKEW, and, after being supported by Mr. JOHN MCCUBBIN, was carried unanimously. The CHAIRMAN expressed his thanks for re-election.

The re-election of Messrs. Cash, Stone, & Co., as Auditors for the current year at their usual fee of fifty guineas, was proposed by Mr. JOHN MCCUBBIN, seconded by Mr. KING-HILLER, and unanimously carried.

The CHAIRMAN then said: You will know by the notice of this meeting that the question of the Directors' remuneration for the past year is to be considered to-day. We had increased business last year, but exchange has gone against the Company, particularly the £3181 for writing-down our assets to 1s. 11¼d. per $. In the computation of Directors' fees, this is brought into account, also the interest on debentures, cost of vertical retorts renewal, and many abnormal working expenses incurred for the year at Hong Kong. The fees are consequently brought to the minimum allowed by our Articles; and I propose the following resolution, which, I hope, will meet with your approval—viz.:

"That the Directors be voted in addition to the amount provided by the Articles, a sum of £500 for their services during the past year 1926."

The motion was seconded by Mr. H. R. ASKEW, and carried unanimously; and the CHAIRMAN expressed his thanks.

The CHAIRMAN proposed a vote of thanks to the staff in Hong Kong and London, which was seconded by Mr. JOHN MCCUBBIN, and carried unanimously.

The SECRETARY briefly responded, and the proceedings then terminated.

LONG SERVICE AT DERBY.

An interesting event in the annals of the Derby Gas Light and Coke Company took place in the Temperance Hall on Friday, April 8, when about 500 employees assembled to greet five retiring colleagues. These men, Messrs. S. Webster (54 years' service), R. Bullivant (52), J. Longdon (54), George Smith (52), and John Potts (50), had a great reception.

Councillor J. FERGUSON BELL, the General Manager and Engineer, who presided, referred to the good feeling which existed among all the employees, and expressed appreciation of this and of the loyal way in which the Company was served by all on the pay-roll.

[*Photo. by "Derby Daily Express."*

Gas Company Employees' Unique Record.

Between them these five men have served the Derby Gas Company for over 260 years. They are (left to right), standing: Mr. J. Longdon, Mr. George Smith, and Mr. R. Bullivant. Seated: Mr. J. Potts and Mr. S. Webster.

Mr. Webster and Mr. Bullivant were each presented by Mr. L. S. R. Stroyan, the Secretary, with an oak bureau. Mr. R. Fisher, the Resident Manager at the Litchurch Gas-Works, handed wallets of notes to Mr. Longdon and Mr. Smith; and Mr. Potts received a similar gift at the hands of Mr. J. P. McCrae, the Assistant Engineer. Mr. Potts and his father had together a continuous record with the Company covering a period of 98 years.

The recipients of the gifts expressed their appreciation of the liberal treatment of the Board of Directors, and of the reception by their workmates.

COOKERY DEMONSTRATION AT WHITBY.

A very successful series of lectures and practical cookery demonstrations was recently held by the Whitby Gas Company. The lecturer was Miss H. H. Tuxford, M.C.A., and the exhibiting firms were John Wright & Co., Wilsons & Mathiesons, Ltd., and R. & A. Main, Ltd. The largest hall in the town was found to be too small

for the evening lectures, especially when Miss Tuxford gave a practical demonstration of the economy of gas by cooking a dinner for six persons with 26 c.ft. of gas at a cost of 2d. A cake baking competition and an essay competition for school girls on "How gas lightens labour in the home" were special features with many entrants. The sale of gas apparatus was a record.

Cheaper Gas at Tredegar.—The price of gas at Tredegar has been reduced to 4s. 3d., with a discount which, in effect, makes the price 3s. 6d. per 1000 c.ft.

METROPOLITAN GAS COMPANIES' OFFICIAL TESTINGS.

The Gas Referees' reports of the official testings for the past quarter give the following average calorific values for the gas supplied by the Metropolitan Companies named:

Commercial Gas Company.—482·8 B.Th.U. (declared calorific value, 475 B.Th.U.).

Gas Light and Coke Company.—501·8 B.Th.U. (declared calorific value, 500 B.Th.U.).

South Metropolitan Gas Company.—561·9 B.Th.U. (declared calorific value, 560 B.Th.U.).

South Suburban Gas Company.—502·3 B.Th.U. (declared calorific value, 500 B.Th.U.).

Tottenham District Light, Heat, and Power Company.—501·8 B.Th.U. (declared calorific value, 500 B.Th.U.).

Wandsworth, Wimbledon, and Epsom District Gas Company.—473·7 B.Th.U. (declared calorific value, 470 B.Th.U.).

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

The market practically closed for the week on Thursday; only routine business in connection with shipments being carried out on Saturday. The slackness of recent weeks continued right up to the holiday, and there was little of the usual pressure at the last moment to obtain coal for the sailing of boats before the long week-end. Northumberland screened steams are still extremely weak; and a good deal of time is being lost. There is an inquiry for a small lot of coal for the Newfoundland railways, about 70,000 tons being required over a period.

Quotations for gas are unchanged; Wear Specials being 17s. 6d. f.o.b., and best qualities 17s. to 17s. 6d. These are moderately steady, but seconds are freely offered at 15s. to 15s. 6d. Coking is weak at about the same price. Best bunkers firmed up a little before the holiday, and were asking 16s. 9d. Gas coke is quoted at 22s. 6d. to 23s. f.o.b. for shipment.

General inquiries are for odd cargoes for early shipment; demand for forward contracts being negligible.

YORKSHIRE AND LANCASHIRE.

With the approach of summer the demand for gas coal in Yorkshire and Lancashire is naturally in accord with climatic and "summer time" conditions. Although it is a little early to predict, it appears that prices will be favourable to buyers during the next few months for forward contracts.

The industrial position continues obscure, with further indications that it will be some considerable time before the key industries are in a position to consume normal supplies of coal. During the past few weeks several qualities that have maintained steady prices since the resumption of work have receded in value. This applies particularly to washed nuts, which are offered at discounted figures.

The demand for coking coals remains steady, although furnace coke itself is slightly easier.

The export market has still to be found, and evidently the foreign competition is more severe than was anticipated.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports: South Yorkshire—Hards, Association, 20s. 6d. to 20s. 9d.; screened gas coal, 19s. 6d. to 21s.; washed trebles, 19s. 6d. to 20s. 6d.; washed doubles, 18s. 9d. to 19s. 3d.; washed singles, 18s. to 18s. 6d.; washed smalls, 16s. to 16s. 6d.; unwashed doubles, 17s. 6d.; rough slack, 12s. 9d. to 13s. 6d.; smithy peas, 19s. 6d. to 21s. 6d. per ton. West Yorkshire—Hartleys (f.o.b. Goole), 18s. to 20s.; screened gas coal, 19s. 6d. to 20s.; washed trebles, 19s. to 20s.; washed doubles, 18s. to 18s. 6d.; washed singles, 17s. 6d. to 18s.; washed smalls, 15s. to 15s. 6d.; unwashed trebles, 18s. 9d. to 19s. 3d.; unwashed doubles, 16s. to 17s.; rough slack, 13s. to 13s. 6d. per ton. Derbyshire and Nottinghamshire—Top hards, 22s. 6d. to 23s. 6d.; washed trebles, 20s. to 20s. 6d.; washed doubles, 18s. 6d. to 19s.; washed singles, 18s. to 18s. 3d.; washed smalls, 15s. to 15s. 6d.; unwashed doubles, 18s. to 19s.; rough slack, 13s. to 14s. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 17s. 6d. to 20s.; gas coke, 25s. to 30s.; furnace coke, 28s. to 30s. per ton. Last week the foreign export of coal from Hull was 38,643 tons.

MIDLANDS.

This has been almost a blank week so far as the production of coal in the Midland are is concerned. Pits closed on Thursday, and only in rare cases where orders warrant it will there be a resumption before the 21st inst. Business in house coal has been extremely slow for some time, though just prior to Easter there was the usual pre-holiday rush to get in stocks.

The lesser production has had the effect of tightening up slacks, which are on the scarce side, with prices very firm at 9s. to 11s. at pithead. There is not the same pressure for D.S. nuts and beans, for which demand and supply about balance.

Reduction in Price at Blyth.—The Directors of the Blyth Gas Company have reduced the price of gas, as from the readings of ordinary meters for the March quarter, and at the conclusion of the current collection from prepayment meters, by 4d. per 1000 c.ft. The new prices are: Ordinary meters—Blyth district, 3s. 6d. per 1000 c.ft. (9·33d. per therm); Bedlington district, 4s. per 1000 c.ft. (10·66d. per therm). Prepayment meters—Blyth district, 4s. 4d. per 1000 c.ft. (11·55d. per therm); Bedlington district, 4s. 10d. per 1000 c.ft. (12·89d. per therm).

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *April* 19.

There has been very little business during the past week. Prices remain practically unchanged, with the exception of white spirits, which are somewhat lower.

Tar Products in the Provinces.

April 14.

The average values of gas-works products during the week were: Gas-works tar, 57s. 6d. to 62s. 6d. Pitch—East Coast, 75s. to 80s. f.o.b. West Coast—Manchester, 72s. 6d. to 79s. 6d.; Liverpool, 75s. to 80s.; Clyde, 77s. 6d. to 80s. Benzole, 90 p.ct., North, 1s. 5d. to 1s. 6d.; crude, 65 p.ct. at 120° C., 1s. 0¼d. to 1s. 0⅜d., naked at makers' works; 50-90 p.ct. naked, North, 1s. 6d. to 1s. 7d. Toluole, naked, North, 1s. 6½d. to 1s. 7½d., nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 1s. 2¾d. to 1s. 3¼d. Heavy naphtha, North, 1s. to 1s. 1d. Creosote, in bulk, North, liquid, 7¼d. to 7⅜d.; salty, 7¼d. to 7½d.; Scotland, 7½d. to 7⅝d. Heavy oils, in bulk, North, 9d. to 9½d. Carbolic acid, 60 p.ct., 2s. 6d. prompt. Naphthalene, £11 to £14; salts, 100s. to 110s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

TRADE NOTES.

Davis Cookers and Geysers.

Two excellently illustrated booklets describing their cookers and geysers have been published by the Davis Gas Stove Company, Ltd., of 60, Oxford Street, W. 1, whose publicity work is of a quality in keeping with the high standard of their appliances. The "Alpine" series of cookers is both efficient and attractive.

Burnley Gas-Works Plant.

The Burnley Corporation Gas Department have decided to instal two "Connersville" station meters, one of 90,000 c.ft. capacity for crude water gas, and one of 150,000 c.ft. capacity for purified gas. The tender of Messrs. Robert Dempster & Sons, of Elland, has been accepted for the provision of two gas oil tanks, each 32 ft. diameter by 20 ft. deep. The tender of Messrs. Spencer-Bonecourt, Ltd., has been accepted for the supply of a waste-heat boiler to attach to the horizontal retort settings.

A Midget Electric Truck.

At the Stepney Electrical Exhibition, which will be held at the People's Palace, Mile End Road, from April 29 to May 7, Messrs. Wingrove & Rogers, of Liverpool and London, will exhibit a "Midget Whippet" electric battery truck. This truck has a carrying capacity of ½ ton; and the particular model to be shown is fitted with an elevating platform operated by hand mechanism, though it can also be supplied with a plain platform. The special feature of this truck is its handiness, as, having only three wheels, its turning radius is 3 ft., and it will turn out of a gangway 4 ft. wide into another gangway 4 ft. wide without reversing. It is thus particularly suitable for transporting materials in confined spaces. It is fitted with rubber tyres, and can be driven by a boy or a girl. Its total weight is with full load under 1 ton, and it is therefore suitable for going into a lift. Its over-all running cost, excluding the boy's wages, but including overhead charges, is from 2d. to 3d. per mile; and it will cover 15 to 20 miles on one charge.

CONTRACTS OPEN.

Exhauster and Engine and Alterations to Plant.

Tenders are invited by the Borough of Stockton-on-Tees for the supply and erection of a four-blade exhauster and steam engine, and for a 24 in. by-pass main, and various alterations to plant. [See advert. on p. 194.]

Pipes and Specials.

The Gas and Lighting Committee of the St. Helens Corporation are inviting tenders for the supply of cast-iron main pipes and specials. [See advert. on p. 194.]

Southgate Chamber of Commerce Visit Sugg's Works.

A party of about fifty members of the Southgate Chamber of Commerce visited Messrs. Sugg's works at Westminster on the afternoon of Thursday, April 7. They were accompanied by their President (Mr. F. J. Oldland), Mr. E. A. Barton (Chairman), and Messrs. C. J. Barnett (North Metropolitan Electric Supply Company) and S. B. Chandler (Tottenham District Light, Heat, and Power Company), Vice-Chairmen. The party were received by Mr. Philip H. Sugg (Chairman of the Company), with whom were Messrs. W. Mattock (Director) and Mr. A. A. Sugg (Secretary). An inspection was then made of the machine shops, foundry, automatic shops, brass finishing, and other departments, including spinning, stamping, metal polishing, assembling, tinsmiths', testing room, and steatite shop. Afterwards tea was partaken of by invitation of the Chairman and Directors; and during this Mr. Philip Sugg welcomed the party, and gave an interesting account of the growth of the firm from its inception in the early part of 1800 to the present day. Mr. Oldland proposed a hearty vote of thanks to Messrs. Sugg & Co. for the interesting and instructive afternoon with "gas, which is one of the most essential things in the world to-day." This was seconded by Mr. Barton, and supported by Mr. Chandler (at whose instigation the visit was arranged) and Mr. Barnett.

STOCK MARKET REPORT.

THERE is little doubt that the absence of any serious additional taxation restored confidence on the Stock Exchange last week, for, notwithstanding the Easter holidays, the volume of business appreciably increased. This was particularly noticeable in the gilt-edged section, where the possibility of a reduction in the Bank Rate is again being discussed; but the general opinion is that the position of the Bank does not justify an early reduction.

The most noticeable effect of the Budget provisions was in the Industrial Market. Dunlop Rubber shares were helped by the new tax on imported tyres. Tobaccos, which had been discounted so heavily in advance, on the additional tax announcement, immediately began to pick up. Oils, Artificial Silks, and Breweries also improved.

The Foreign Government Market was firm. Chinese issues rallied on the joint note by the Great Powers. Even Home Rails were in greater demand.

The Gas Market was satisfactory. An interesting feature was that the South Metropolitan stock found a buyer at 100. When it is remembered that this Company's stock prior to the war was a 4½ p.ct. investment, it will be realized there is still, at the present 6 p.ct. dividend, room for improvement, especially as it is conceivable that a higher dividend may be paid. The only changes in the quotations were a rise of 1 point in the Commercial 3½ p.ct. stock to 82-85, and ½ point in South Metropolitan ordinary to 98½-100½. At the local exchanges, there was a rise of ½ point in Liverpool ordinary, to 80½-81½, and Tynemouth consolidated and new, and a slight drop in Newcastle consolidated.

The following transactions were recorded during the week:

On Monday, Bahia-Blanca "A" 1s., Commercial 3½ p.ct. 82½, 83½, 84, Croydon sliding-scale 96¼, 97, maximum dividend 79, 79⅛, European 6½, 6 5/16, Gas Light and Coke, 87¼, 87⅜, 87⅞, 3½ p.ct. maximum 59½, 4 p.ct. preference 76½, 3 p.ct. debenture 59½, Imperial Continental 139, 139½, 141, Primitiva 14s. 3d., 14s. 6d., South Metropolitan 98¾, 99¼, 99⅞, Uxbridge 5 p.ct. Maidenhead 86, Wandsworth (Wimbledon 5 p.ct.) 101½, 102. Supplementary prices, Oxford 5 p.ct. 128½, Wandsworth 3½ p.ct. new 91, 91½.

On Tuesday, Alliance and Dublin 84¼, 85¼, Bombay 21s. 10⅛d., 22s. 1⅛d., Gas Light and Coke 87½, 87⅝, 87⅞, 4 p.ct. preference 76, 3 p.ct. debenture 59½, Imperial Continental 140, Primitiva 14s. 3d., 14s. 6d., South Metropolitan 99, 99⅜, South Suburban 102½, Swansea 7 p.ct. preference 101½. Supplementary prices, Hartlepool 5 p.ct. maximum 84½, Southend-on-Sea 5 p.ct. new 81, 81½.

On Wednesday, Alliance and Dublin 84, British 107, 108, Commercial 3½ p.ct. 84, 84⅜, Gas Light and Coke 87½, 87⅜, 87⅞, 88, 3½ p.ct. maximum 60⅛, 60½, 4 p.ct. preference 77, 6 p.ct. debenture 102½, 5 p.ct. debenture 99¼, 100, Imperial Continental 141, Primitiva 14s. 6d., 4 p.ct. consolidated debenture 71, 71½, 4 p.ct. debenture (1911) 71, South Metropolitan 99, 99½, 99⅜, South Suburban 5 p.ct. 102½, Wandsworth (Wimbledon 5 p.ct.) 100. Supplementary prices, South Suburban 7 p.ct. debenture 103, Yorktown and Blackwater new 5 p.ct. preference 87.

On Thursday, Croydon sliding-scale 96½, Gas Light and Coke 87¼, 87⅜, 87⅞, 3½ p.ct. 60, 60⅛, 60½, 4 p.ct. preference 76½, 76⅝, 3 p.ct. debenture 58½, 5 p.ct. debenture 100⅛, 100¼, 100⅜, Primitiva 14s. 6d., 14s. 7½d., South Metropolitan 99¼, 100, Tottenham "B" 91¼.

In Lombard Street the short loan market experienced easier conditions at the close of the week. Fresh money was obtainable at from 4 p.ct. down to 3½ p.ct. The position of the Money Market was dominated by the approaching repayment of the balance of the loan (about £33,000,000) from the Bank of England to the Bank of France. Discount business was quiet, but rates eased on the result of the Treasury Bill allotment. These were allotted at an average of £4 3s. 3·79d. p.ct.; the lowest rate for the past three months, and nearly 2s. p.ct. below the average for the previous week.

On the Foreign Exchange Market there was considerable activity in Italian lire; and after some erratic movements, the closing quotation was 97⅛. The French exchange was steady at 124; the Belgian and Dutch rates remained unchanged; and Sterling on New York was slightly easier at 4.85⅝.

Silver was firmer as a result of both Indian and Chinese buying, but the price was unaltered at 26d. per oz. No Gold was available, and the price remained nominally at 84s. 11½d. per oz.

The Bank Rate is 5 p.ct., to which it was raised from 4 p.ct. on Dec. 3, 1925. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3⅛ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Apl. 14.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,978	Stk.	Feb. 10	5	5	Aldershot 5 p.c. max. C.	70—73	..	..
228,992	,,	,,	4	4	Do. 4 p.c. Pref.	66—71	..	..
1,151,888	,,	Apl. 7	6½	7	Alliance & Dublin Ord.	83—86*	..	84—85½
174,000	,,	Jan. 18	4	4	Do. 4 p.c. Deb.	65—68	..	..
800,000	1	Oct. 14	1/7½	1/7½	Bombay, Ltd.	1—1½	..	21/10½—22/1½
170,000	10	Mar. 10	8½	8½	Bournemouth 5 p.c.	12⅞—13½	..	..
600,050	10	,,	7	7	Do. B 7 p.c.	11⅞—12⅞	..	..
275,000	10	,,	6	6	Do. Pref. 6 p.c.	10⅞—11⅞	..	..
50,000	Stk.	Jan. 13	3	3	Do. 3 p.c. Deb.	53—56	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	73—76	..	..
367,900	,,	—	—	—	Brighton & Hove 6 p.c. Con.	100—105	..	..
341,800	,,	—	—	—	Do. 5 p.c. Con.	90—95	..	..
1,327,500	,,	Feb. 24	5	5	Bristol 5 p.c. max.	88—89a	..	..
865,000	,,	Mar. 24	8	7	British Ord.	105—108	..	107—108
100,000	,,	Dec. 30	7	7	Do. 7 p.c. Pref.	112—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	75—80	..	..
100,000	10	Dec. 9	8	6	Cape Town, Ltd.	7—8	..	..
100,000	10	Oct. 28	4½	4½	Do. 4½ p.c. Pref.	6—7	..	..
180,000	Stk.	Dec. 30	4½	4½	Do. 4½ p.c. Deb.	68—73	..	..
668,880	,,	Feb. 24	6	6	Cardiff Con. Ord.	99—102	..	..
927,880	,,	Dec. 30	7½	7½	Do. 7½ p.c. Red. Deb.	100—103	..	..
187,150	,,	Feb. 24	5	6½	Chester 5 p.c. Ord.	86½—91½b	..	..
79,185	1	Sept. 30	†2/-	†2/-	Colombo Ltd. Ord.	27/—29/-	..	..
24,495	1	,,	1/4§	1/4§	Do. 7 p.c. Pref.	20/—22/-	..	..
931,490	1	Apl. 7	1/9⅜	1/9⅜	Colonial Gas Assn. Ld. Ord.	24/6—26/6*	..	..
178,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-*	..	..
1,518,280	Stk.	Feb. 24	5½	5½	Commercial 4 p.c. Cap.	88—86	..	..
840,000	,,	,,	5/3/4	5/3/4	Do. 3½ p.c. Cap.	82—85	+1	82½—84⅜
475,000	,,	Dec. 30	3	3	Do 3 p.c. Deb.	54—57	..	..
900,000	,,	Sept. 30	§2	§1	Continental Union, Ltd.	28—38	..	..
200,000	,,	Mar. 10	7	7	Do. 7 p.c. Pref.	79—82	..	..
707,560	,,	Mar. 10	6½	6½	Croydon sliding scale	96—99	..	96⅜—97
408,100	,,	,,	5	5	Do. max. div.	77—80	..	79—79⅜
499,970	,,	Feb. 24	6	9	Derby Con.	104—106e	..	..
55,000	,,	Dec. 30	4	4	Do. Deb.	78—75e	..	..
200,000	,,	Mar. 10	5	5	East Hull Ord. 5 p.c.	76—80	..	..
50,000	,,	Dec. 30	5	5	Eastbourne 5 p.c. Deb.	92—97	..	..
1,000,180	10	Mar. 24	†3	†3	European, Ltd.	5⅞—6⅝	..	6⅛—6 5/16
18,747,460	Stk.	Feb. 10	5/1/4	5	Gas Light & Coke 4 p.c. Ord.	86¼—88⅛	..	87½—88
2,000,000	,,	,,	3½	3½	Do. 3½ p.c. max.	58—61	..	59¼—60½
4,187,080	,,	,,	4	4	Do. 4 p.c. Con. Pref.	75—78	..	76—77
5,606,620	,,	Dec. 30	3	3	Do. 3 p.c. Con. Deb.	58—61	..	58½—59½
181,315	,,	,,	—	6	Do. 6 p.c. Br'tf'd Rd. Db.	100—105	..	102½
1,442,770	,,	,,	—	5	Do. 5 p.c. Red. Deb.	99—101	+½	99½—100⅜
40,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
88,500	,,	Mar. 10	6½	6½	Hastings & St L. 5 p.c. Conv	88—90	..	..
389,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	66—70	..	..
70,000	10	Oct. 14	†10	†10	Hongkong & China, Ltd.	12—13	..	..
178,800	Stk.	Mar. 10	5	5	Hornsey Con. 3½ p.c.	67—69	..	..
1,976,000	,,	Nov. 11	†10	10	Imperial Continental Cap.	138—141	..	139—141
203,180	,,	Feb. 10	3½	3½	Do. 3½ p.c. Red. Deb.	69—71	..	..
235,242	,,	Mar. 10	6½	6½	Lea Bridge 5 p.c. Ord.	92—97	..	..
3,145,907	,,	Feb. 24	5½	5½	Liverpool 5 p.c. Ord.	80½—81½b	+½	81½
600,000	,,	Sept. 30	7	7	Do. 7 p.c. Red. Pref.	101—103b	..	..
165,786	,,	Feb. 24	9	8	Maidstone 5 p.c. Cap.	110—115	..	..
62,480	,,	Dec. 30	3	3	Do. 3 p.c. Deb.	52—57	..	..
75,000	5	Dec. 9	†7	†7	Malta & Mediterranean	5½—6½	..	..
541,920	Stk.	Nov. 25	†6	†5	Montevideo, Ltd.	80—83	..	..
2,051,315	,,	Feb. 24	5	5	Newcastle & Gateshead Con.	73½—74½d	−½	..
380,929	,,	,,	4	4	Do. 4 p.c. Pref.	68½—69½d	..	..
691,705	,,	Dec. 30	3½	3½	Do. 3½ p.c. Deb.	68—69d	..	..
131,785	,,	—	—	—	North Middlesex 6 p.c. Con.	93—95	..	..
800,000	,,	Nov. 25	7	9	Oriental, Ltd.	97—102	..	..
188,120	,,	Dec. 30	7½	7½	Plym'th & Ston'house 5 p.c.	105—110	..	..
414,500	,,	Feb. 24	7½	7½	Portsm'th Con. Stk. 4 p.c. Std.	100—105	..	..
236,782	,,	,,	5	5	Do. 5 p.c. max.	76—79	..	..
2,289,909	1	—	—	—	Primitiva Ord.	14/3—15/3	..	14/3—14/7½
392,200	100	Dec. 1	4	4	Do. 4 p.c. Red. Deb.	85—87	..	..
600,000	Stk.	Jan. 27	4	4	Do. 4 p.c. Red. Deb. 1911	70—72	..	71
434,968	,,	Dec. 30	—	4	Do. 4 p.c. Cons. Deb.	70—72	..	71—71½
150,000	10	Mar. 24	6	6	San Paulo 6 p.c. Pref.	7½—7⅝	..	..
125,000	50	July 1	5	5	Do. 5 p.c. Red. Deb.	47—50	..	..
270,000	Stk.	Mar. 24	5⅜	5⅜	Sheffield A	95—97e*	..	..
419,968	,,	,,	5⅜	5⅜	Do. B	95—97e*	..	..
1,047,000	,,	,,	5⅜	5⅜	Do. C	95—97e*	..	..
90,000	10	June 11	4	—	South African	4—6	..	..
3,609,895	Stk.	Feb. 24	5	7	South Met. Ord.	98½—100½	+½	98⅝—100
1,505,445	,,	Jan. 13	3	3	Do. 3 p.c. Deb.	57—60	..	..
784,000	,,	Mar. 10	6½	6½	Do. 6½ p.c. Red. Db.	99—101	..	..
91,500	,,	Feb. 24	8½	8½	South Shields Con.	105—107d	..	..
1,343,795	,,	Mar. 10	6½	6½	South Suburban Ord. 5 p.c.	101—104	..	102½—102½
868,887	,,	Dec. 30	5	5	Do. 5 p.c. Deb.	93—96	..	..
647,740	,,	Mar. 24	5	5	South'mpton Ord. 5 p.c. max.	74—77	..	..
121,275	,,	Dec. 30	4	4	Do. 4 p.c. Deb.	68—73	..	..
350,000	,,	Feb. 24	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	101½
200,000	,,	Dec. 30	6½	6½	Do. 6½ p.c. Red. Deb.	102—104	..	..
190,000	,,	Feb. 24	7½	7½	Tottenham District A 5 p.c.	105—110	..	..
882,275	,,	,,	6½	6½	Do. B 3½ p.c.	89—92	..	91½
180,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
181,255	,,	Dec. 9	4	4	Do. 4 p.c. Deb.	72—75	..	..
268,251	,,	Mar. 10	5	5	Tynemouth Con. and New	69—71d	+½	..
197,294	,,	Mar. 10	6½	6½	Uxbridge, Maidenhead, & Wycombe 5 p.c.	85—90	..	..
98,330	,,	,,	5	5	Do. 5 p.c. pref.	88—88	..	..
91,800	,,	,,	6½	6½	Do. 5 p.c. Maidenh'd	83—88	..	86
80,000	,,	Mar. 10	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	120—125	..	..
256,856	,,	,,	7	7	Do. B 3½ p.c.	102—107	..	..
432,535	,,	,,	5/19/0	5/19/0	Do. C and New	90—95	..	..
852,000	,,	,,	6⅝	6⅝	Wimbledon 5 p.c.	96—103	..	100—102
96,000	,,	,,	7⅛	7⅛	Epsom 5 p.c.	103—108	..	..
88,416	,,	Dec. 30	3	3	3 p.c. Deb.	54—57	..	..

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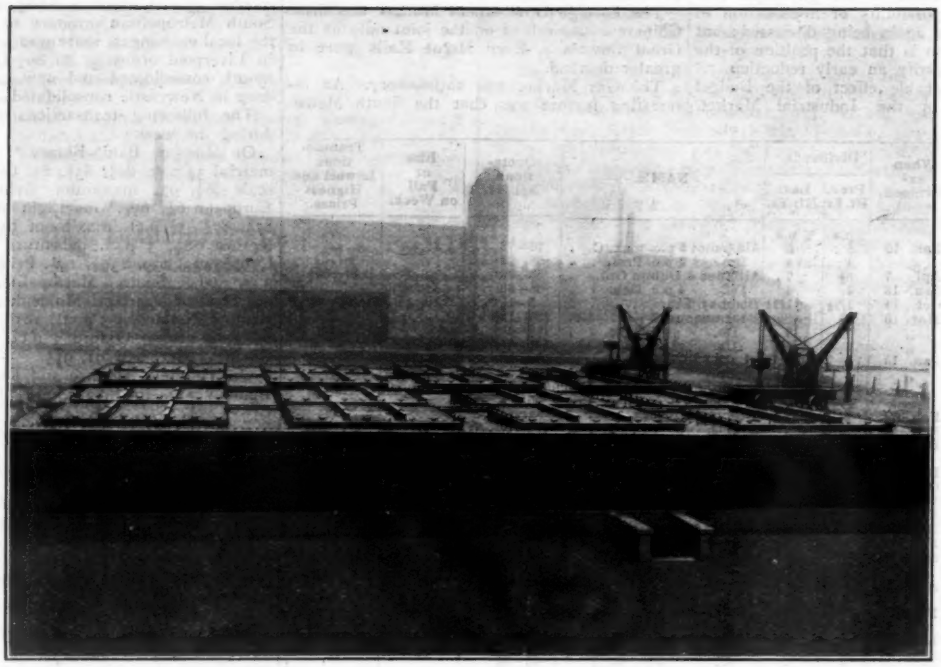

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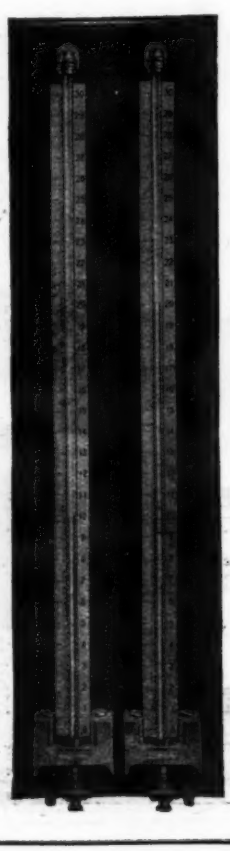

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